

# **RANGELAND MANAGEMENT IN IRAN**

## **A SOCIO-ECONOMIC ANALYSIS AND CASE STUDY OF SEMNAN RANGELANDS**

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## **List of Abbreviations**

ANOVA	Analysis of variance between groups
AU	Animal Unit
BLGC	Balancing livestock with grazing capacity
CPR	common property regime
CR	common property regime with rotational access
CU	common property regime with a unique decision maker
DM	Dry Matter
FMC	American company
GL	Grazing Licence
GNP	Gross National Product
IAD	Institutional Analysis and Development
Mini	Mini CPR within CPR
NGO	Non-Governmental Organization
NIE	New Institutional Economics
PUR	Property in-use regimes
RMP	Rangeland Management Plan
TDN	Total Digestible Nutrient
UCPR	unregulated common property regime

## **Zusammenfassung**

### ***Problemstellung***

Rangelands sind weltweit Lebensgrundlage für hunderte von Millionen Bauern. Eine weithin akzeptierte Definition stammt von der *American Society for Range Management* (zitiert nach McGuire 1978): *Rangelands are „...lands on which the native vegetation is predominantly grasses, grass like plants, forbs or shrubs suitable for grazing or browsing use which includes lands revegetated naturally or artificially to provide a forage cover that is managed like native vegetation....“*. Vorrangig sind Rangelands in semi-ariden Gebieten zu finden – dort sind aufgrund von zu geringen oder ungleich im Jahresgang verteilten Niederschlägen zumeist andere agrarwirtschaftliche Nutzungen als Weide, wenn überhaupt, nur nachrangig zu finden.

Im Iran sind die semi-ariden Rangelands die flächenmäßig größten terrestrischen Ökosysteme. Die in der Literatur genannten Schätzungen variieren – mit Badripour et al. (2006) kann man von knapp 55 % der Landoberfläche des Iran ausgehen. Rangelands sind für den Iran von herausragender gesellschaftlicher Bedeutung (mehr als 2,5 Mill. Menschen leben als Semi-Nomaden in verschiedensten Form von der Weidenutzung der Rangelands) und von großer ökonomischer Bedeutung (rund 6 % des inländischen Bruttosozialprodukts werden in den Rangelands erwirtschaftet, insbesondere durch Produkte wie Fleisch, medizinische Pflanzen und Kräuter sowie Honig). Darüber hinaus kommt den Rangelands hohe ökologische Bedeutung zu (Schutzfunktionen, Biodiversität).

Seit vielen Jahrzehnten wird in der Literatur von dramatischen Degradationen der Rangelands berichtet, verursacht durch Fehl- und Übernutzungen (Weide zur Unzeit, jahreszeitlich zu lange Weide, Überbesatz an Vieh usw.). Staatliche Programme wie der „Rangeland Management Plan“ (RMP) und „Grazing Licences“ (GL) haben diese Zerstörungen der Rangelands durch Fehl- und Übernutzung nur partiell aufhalten können. Offensichtlich ist die tatsächliche Nutzung der Rangelands maßgeblich durch informale (nichtstaatliche, lokale) Regeln und nicht durch staatliche Regulierung geprägt.

## ***Fragestellungen der Arbeit***

Zentrale Anliegen vorliegender Arbeit sind

- die Beschreibung der Nutzungssysteme der Rangelands im Iran, wie sie in der Praxis tatsächlich vorzufinden sind und
- die Erklärung der Prozesse der dramatischen Degradationen der Rangelands als Auswirkungen des Handelns der Semi-Nomaden im Spannungsfeld von staatlichen Programmen und informalen Institutionen vor Ort.

## ***Zur Grobgliederung***

Die Arbeit ist in drei große Hauptkapitel gegliedert.

Basierend auf den Theorien der Neuen Institutionenökonomik, besonders auf den Arbeiten von Ostrom, wird in Kapitel B eine sozioökonomische Analyse der Landnutzung in Iran durchgeführt. Diese bildet den theoretischen Rahmen für die nachfolgenden empirischen Studien. Die Übernutzung des Weidelands wird erklärt als Auswirkung des Handelns der lokalen Nutzer, die nicht die Möglichkeit haben, die sozialen Bedingungen wie die Eigenschaften der Ressourcen oder die kulturellen Traditionen direkt zu beeinflussen.

In Kapitel C werden die Ergebnisse der empirischen Fallstudie präsentiert sowie die verschiedenen identifizierten Landnutzungssysteme der Untersuchungsregion Semnan vorgestellt.

In Kapitel D werden die Ergebnisse der sozioökonomischen Analyse, die hauptsächlich auf Literaturrecherchen basieren, in Verbindung gebracht mit den Ergebnissen der empirischen Studie. Abschließend werden Schlussfolgerungen zur Rangeland-Nutzung im Iran gezogen und offene Forschungsfragen angesprochen.

## ***Literaturüberblick: Probleme des Managements der Rangelands im Iran (Kapitel B I)***

Kapitel B I dient der ausführlichen Information zu der o. g. Problemstellung. Es wird ein Überblick gegeben über die ökologischen Eigenschaften der Rangelands des Iran, ihre Produktivität für Viehwirtschaft sowie ihre Vielgestaltigkeit aus Sicht der Nutzung durch Nomaden und Bauern. In einem umfänglichen historischen Rückblick werden die staatlichen Bemühungen um Steuerung der

nachhaltigen Nutzung der Rangelands seit der islamischen Revolution 1978 erläutert.

***Theoretischer Bezugsrahmen: Management von Common Pool Ressourcen aus Sicht der Neuen Institutionenökonomik (NIE) (Kapitel B II)***

Theoretische Grundlegung für die Arbeit sind die Theorien der NIE, insbesondere die Arbeit von Ostrom. In Abgrenzung vor allem zur neoklassischen Ökonomik wird zunächst dargelegt, worin der wissenschaftliche Fortschritt mit der zusätzlichen Betrachtung von informalen und formalen Institutionen zur Erklärung von Nutzungssystemen von Common Pool Ressourcen besteht. Die diesbezüglichen Grundlagen der NIE werden ausführlich dargelegt und dienen schließlich (in enger Anlehnung an die Arbeiten von Ostrom) zur Entwicklung eines Modells der Nutzung von Rangelands im Iran. „Property in Use Systeme“ (PUR) werden strukturiert durch die so genannte „action arena“, umschrieben als alle das jeweilige lokale Handeln bestimmenden formalen und informalen Institutionen. Dieses Nutzungshandeln hat ökologische, ökonomische und soziale Gegebenheiten zur Folge (die so genannten „outcomes“). Die empirisch feststellbaren Unterschiede lokaler PURs werden erklärt mit unterschiedlich vorzufindenden Eigenschaften der Ressource Rangeland, der lokalen Gruppenzugehörigkeit, des Dorfes/der Stadt und der vorgegebenen Märkte. Dieses Modell dient als theoretischer Bezugsrahmen für die folgenden empirischen Studien.

***Gründe für die Auswahl der Untersuchungsregion Semnan***

Die Hauptkriterien für die Auswahl der Untersuchungsregion waren:

- Zugang und ausreichende Daten und Informationen zu den ökologischen Bedingungen der Rangelands
- Die Vergleichbarkeit der eigenen Daten mit anderen Forschungsprojekten und Studien über Rangeland-Nutzung in Iran

Zugang zu ausreichenden Daten und Informationen über die ökologischen Bedingungen der Rangelands des Iran zu bekommen ist keine triviale Angelegenheit aufgrund der großen räumlichen Ausdehnung der Rangelands. Daher war der Zugang zu ausreichenden Informationen zu den ökologischen Bedingungen eines der Hauptkriterien für die Auswahl der Untersuchungsregion. Für nahezu alle Rangelands der Untersuchungsregion waren Informationen zu der

Futtermittel-Produktivität der Weiden mit Bezug zu den Rangeland Management Plänen (RMP) oder den Weide-Lizenzen (GL) zugänglich. Die Vergleichbarkeit der Daten mit anderen Forschungsprojekten und Studien über Weideland-Nutzung in Iran war das zweite Auswahlkriterium. Die Auswahl der Kriterien erfolgte mit Hilfe der staatlichen „Forest, Range and Watershed Management Organization“ im Iran.

### ***Die Ziele der empirischen Studie***

Die Ziele waren

- den Diffusionsprozess und die Diffusionsgeschwindigkeit des „Rangeland Management Plans“ in der Region Semnan zu analysieren,
- die Landparzellen in der Region Semnan zu beschreiben sowie die Wahrnehmung der Nutzer in Bezug auf die Rangeland-Bedingungen und den Zweck der Landnutzung zu untersuchen,
- die Reaktion der Nomaden bzw. Halb-Nomaden auf die staatlichen Regulationsversuche zu analysieren,
- die Typen der informellen Institutionen, die aktuell in Semnan angewendet werden, zu identifizieren,
- die Typen der informellen Institutionen in Bezug auf das jeweils angewendete Nutzungsregime zu klassifizieren,
- Faktoren zu identifizieren, die das jeweils angewendete Nutzungsregime beeinflussen,
- die Wahrscheinlichkeit der Umsetzung des „Rangeland Management Plans“ in der Region Semnan aus Sicht der Nutzer mit Hilfe der identifizierten Faktoren abzuschätzen.

### ***Methoden***

An den Fragestellungen pragmatisch orientiert kamen verschiedenste Methoden zur Anwendung: Dokumentenanalysen (v. a. offizielle Statistiken und Dokumente), Literaturanalysen (wissenschaftliche Arbeiten verschiedenster Disziplinen zur Nutzung der Rangelands in Semnan, darüber hinaus für Vergleichsziecke aber auch mit Bezug zu anderen Regionen im Iran und weltweit)

sowie Methoden der quantitativen empirischen Sozialforschung (Interviews, Datenauswertung mittels beschreibender und schließender Statistik) und der qualitativen empirischen Sozialforschung.

***Ergebnisse Teilstudie 1: Der Diffusionsprozess der staatlichen Politikinstrumente „Rangeland Management Plans“ (RMP) und „Grazing License“ (GL) (Kapitel C IV)***

Dieses Kapitel beginnt mit einer Beschreibung des Diffusionsprozesses des „Rangeland Management Plans“ in der Untersuchungsregion. Auf die Analyse der regionalen Unterschiede folgt eine Einführung in das so genannte „Bass Modell“ (nach Bass (1969); siehe auch Kapitel B II 4.1). In dem „Bass Modell“ werden die Koeffizienten geschätzt, die den Diffusionsprozess der RMP und GL in Semnan beschreiben. Das Modell liefert u. a. Hinweise zur Diffusionsgeschwindigkeit, mit der die lokalen Nutzer die Innovation umsetzen. Die Geschwindigkeit wird mit den folgenden Koeffizienten geschätzt:

- *Koeffizient  $p$*  schätzt die individuelle Tendenz die Innovation anzuwenden
- *Koeffizient  $q$*  schätzt den Einfluss von vorherigen Nutzern auf potentielle Nutzer

***Ergebnisse Teilstudie 2: Einstellungen der lokalen Nutzer der Rangelands zu den staatlichen Programmen RMP und GL (Kapitel C V)***

Dieses Kapitel beginnt mit einer Beschreibung der Landparzellen in Semnan, die für die Analyse der Perspektive der Nutzer im Hinblick auf RMP und GL genutzt werden. Die Stichprobe wird zunächst hinsichtlich soziodemographischer Charakteristika der Befragten beschrieben ( $n = 70$ ). Die Nutzer wurden zu ihren Wahrnehmungen bezüglich der Bedingungen der Rangelands sowie bezüglich der Zwecke der Landnutzung befragt. U. a. werden folgende Aspekte von den Nutzern herausgestellt:

- Vorteile wie die Bestimmung der Landgrenzen
- Nachteile wie fehlender Zugang, hohe Anpassungskosten und reduziertes Einkommen
- Kompatibilität der „Rangeland Management Plans“ mit den Traditionen
- Problem der „Sichtbarkeit“ der Auswirkungen des RMP
- Trockenheit als (vermeintlicher) Hauptgrund für Degradationen
- Mißtrauen in das staatliche Regulierungssystem

- Eigentumsverhältnisse und Privatisierung

Das Kapitel endet mit einer Diskussion zu den wichtigsten Ergebnissen.

### ***Ergebnisse Teilstudie 3: Aktuelle informelle Institutionen (Kapitel C VI)***

Zunächst wird ein historischer Überblick zum Rangland-Management in der Untersuchungsregion gegeben. Staatliche Programme und die Reaktion der Nomaden auf diese Programme werden literaturgestützt beschrieben. Anhand der Analyse der derzeitigen informellen Institutionen werden Gründe für die Etablierung von Nutzungsregeln (Strategien) identifiziert sowie die Existenz von Sanktionen erklärt.

### ***Ergebnisse Teilstudie 4: Aktuelle „Property in Use Systeme“ (PUR) (Kapitel C VII)***

Dieses Kapitel knüpft an die vorherigen Teilstudien mit einer Klassifikation der identifizierten informellen Strategien an. Es werden „Property in Use Strategien“ (in Bezug auf Eigentumsrechte), „Production in Use Strategien“ (in Bezug auf Produktion) und „Exclusion in Use Strategien“ (in Bezug auf Ausschluss-Optionen) identifiziert. Jede dieser Strategie wird detailliert in Beziehung gesetzt zu den jeweils vorgefundenen Eigentumsrechten im Untersuchungsgebiet.

Der Begriff „Property in Use Regimes“ (PUR) dient zur Klassifizierung von typischen „Mustern“ der kombinierten Nutzung von oben genannten Strategien. Es wurden vier Nutzungsregime identifiziert:

- unregulated common property regime (UCPR)  
(“nicht reguliertes Nutzungsregime”)
- common property regime with rotational access (CR)  
(“Nutzungsregime mit turnusmäßigem Zugang”)
- common property regime with a unique decision maker (CU)  
(“Nutzungsregime mit einem einzigen Entscheidungsträger”)
- Mini common property regime (Mini) (“Mini-Nutzungsregime”)

Diese Nutzungsregime unterscheiden sich deutlich bezüglich wesentlicher Einflussfaktoren wie „resource characteristics“ (Eigenschaften der Ressourcen), „village characteristics“ (Eigenschaften der untersuchten Gemeinden) und „group characteristics“ (Eigenschaften der Gruppen bzw. Gruppenzugehörigkeit“). Um die jeweils zentralen Einflussfaktoren für die verschiedenen Nutzungsregime zu



bestimmen, kamen die statistischen Modelle der Faktorenanalyse, der Varianzanalyse und der multinomialen logistischen Regression zur Anwendung. Als wesentliche Größen werden bezüglich “resource characteristics“ die Faktoren Winter-, Sommer- und Frühlings- Weideland), bezüglich der „village characteristics“ die Faktoren Bevölkerungsdichte und „Dorf-Typ“ sowie bezüglich der „group characteristics“ die Faktoren Alter, Beruf, Bildung, Einkommen, Wohnort und Größe der Herde in die Analyse einbezogen. Mittels der multinomialen logistischen Regression kann einerseits die Wahrscheinlichkeit bestimmt werden, mit der das jeweilige Nutzungsregime tatsächlich zur Anwendung gelangt. Zum anderen kann gezeigt werden, dass die verschiedenen Nutzungsregime in unterschiedlichem Maße zur Degradation der Rangelands beitragen.

### ***Schlussfolgerung***

Die empirischen Ergebnisse zur Nutzung der Rangelands in Semnan zeigen, dass die Nutzer unabhängig von den staatlichen Regulierungsversuchen ihre eigenen Regeln entwickelt haben. Ein großer Teil der lokalen Institutionen, die mit dem Rangeland-Management verknüpft sind, haben den Status von „Strategien“ und sind nicht als Normen internalisiert. Daher kann geschlussfolgert werden, dass die lokalen Institutionen noch in der Entwicklung sind. Dies kann als große Chance der Gestaltung gesehen werden. Es scheint Möglichkeiten zu geben, die existierenden Institutionen des Rangeland-Managements zu verbessern oder gar neue institutionelle Regeln zu entwickeln.

Die Befragungen haben verschiedene Gründe für die Nicht-Umsetzung des RMP aufgedeckt:

- Die “Nicht-Sichtbarkeit der oben definierten “outcomes” und der Nutzenstiftungen, die mit dem Plan verbunden sind
- Fehlendes Wissen über den RMP
- Fehlendes Vertrauen in den Staat und die Besitzverhältnisse
- Einschätzungen zum Problem der Trockenheit .

Ein Lösungsvorschlag zur “Nicht-Sichtbarkeit“ der Wirkungen der RMP ist die Bereitstellung von Informationen, z.B. durch Informationskampagnen. Öffentlichkeitsarbeit und Zugang der lokalen Bevölkerung zu derartigen Informationen sollte sichergestellt werden. Workshops, Fernsehen und Radio

sowie symbolische Zeremonien für die kooperativen Gruppen sind Vorschläge aus der ausgewerteten Literatur (siehe hierzu Hejazi 2007).

Ein Lösungsvorschlag für das fehlende Vertrauen in den Staat sowie in die Besitzverhältnisse könnte die Privatisierung sein. Zwar hatten die Nutzer kein besonderes Interesse an der Privatisierung der Rangelands. Die Ergebnisse haben aber gezeigt, dass Sommer-Weiden im Gegensatz zu Winter-Weiden bevorzugt wurden. Allerdings konnten keine Gründe für diese Präferenzen in der vorliegenden Untersuchung identifiziert werden.

Für das Problem der Einschätzungen zur Bedeutung von Trockenheit für die Degradationen wird empfohlen, ein ausführliches Monitoring von Trockenheitsperioden bzw. -zyklen mit ihren Langzeitwirkungen auf die Nutzungsregime zu etablieren. Im Hinblick auf die Equilibrium-Theorie (Gleichgewichtstheorie) sollte beispielsweise untersucht werden, ob und inwiefern Rangelands im Iran die Bedingungen des Gleichgewichts überhaupt erfüllen. Ein derartiges Monitoring könnte positiven Einfluss auf den Erfolg von staatlichen Programmen wie RMP haben. Ein weiterer Lösungsvorschlag wäre die Folgen von Trockenperioden mit entsprechenden Managementmaßnahmen zu begegnen - z. B. die Fütterung während der Weide-Pausen sicherzustellen und Pläne hierfür weiter zu entwickeln.

Eine Alternative zu den staatlichen Regulierungen könnten schließlich selbstregulierte Systeme sein. Ohne Zweifel würde die Entwicklung von selbstregulierten Systemen der gemeinsamen Nutzung der Rangeland insbesondere wegen der Vielfalt und der Vielschichtigkeit der Interessen der lokalen Nutzer sowie der Transaktionskosten für Vereinbarungen bzw. Verhandlungen große Anstrengungen erfordern (Houtte 2001, Macadam and Drinan 2004, McAdams and Rasmusen 2007). Derartige Systeme böten aber immerhin eine Option, die derzeitige Situation im Hinblick auf die Bedürfnisse der lokalen Nutzer zu verändern bzw. eventuell zu verbessern – z. B. zu veränderter Einkommenssituation beizutragen. Die Weitergabe von für das Rangeland-Management wichtigen Informationen könnten innerhalb eines selbstregulierten Systems - unabhängig von staatlichen Regulierungen - eine Lösungsstrategie für das fehlende Wissen sein. Ein selbstreguliertes Systems würde schließlich dem Problem des fehlenden Vertrauens in die staatlichen Regulierungen entgegen wirken.

## Summary

### ***Problem statement***

Rangelands are the livelihood for hundreds of millions of farmers-. An widely accepted definition from the *American Society for Range Management* (cited after McGuire 1978) is: *Rangelands are „...lands on which the native vegetation is predominantly grasses, grass like plants, forbs or shrubs suitable for grazing or browsing use which includes lands revegetated naturally or artificially to provide a forage cover that is managed like native vegetation....”*.

Rangelands can be found previously in semi-arid areas – due to this fact other agricultural uses than pasture can be found rarely.

In Iran, the semi-arid rangelands cover the majority of the terrestrial areas. Regarding the area of rangeland in Iran, different figures can be find in the literature, due to using various definitions. Badripou et al. (2006) estimate that 55% of the Iranian land is occupied by rangelands. Rangelands have a great importance for the society - more than 2.5 million people live as semi-nomads in different regions. The rangelands are also of great economic importance, 6% of the gross national product are meat, medical plants, herbs, and honey. Moreover, the rangelands fulfil important ecological functions such as the provision of biodiversity and the maintenance and preservation of biotic cycles.

Since several decades there has been reported dramatic degradation of the rangelands, mainly affected by overuse (untimely grazing, overexploitation and overstocking). Governmental plans as the rangeland management plan and grazing licences rarely contributed to the problem of overgrazing. Obviously the informal institutions play the most important role in extracting the rangeland resources.

### ***The central aims of the thesis are***

- to describe the practical systems of rangeland management in Iran (the case study of Semnan)
- To find explanations of the processes of the dramatic degradation of the rangelands as effects of acting of the semi-nomads in the face of

governmental programs and informal institutions applied in Semnan Province

### ***Structure of the thesis***

The thesis is structure in three main parts. The following two research approaches are used to answer these central objectives:

- Based on the theories of New Institutional Economics, especially Elenor Ostrom 's literature on the common property management and an extensive socio-economic analysis of land use in Iran, the theoretical framework for the empirical study is developed in chapter B. This framework presents the overuse of rangelands as effect of local institutions that were rarely influenced by the cultural traditions, instead the “resource characteristics”, “group characteristics”, “village characteristics” and “market.
- Based on this theoretical framework, chapter C presents the empirical case study to describe and explain the different rangeland use regimes in Semnan Province.
- In chapter D, the results from the predominantly literature based analysis of socio-economic conditions in Semnan Province are connected with results from the empirical case study. Conclusions for rangeland management in Iran are drawn and questions for further research are recommended.

### ***Literature overview: Problems of the management of the rangelands in Iran (Chapter BI)***

Chapter BI gives detailed information on the stated problem. An overview is being given in terms of ecological characteristics of the rangelands in Iran, the productivity of livestock, diversity in terms of usage by nomads and farmers. A historical outline of the governmental programs to regulate sustainable use of rangelands since the Islamic revolution in 1978 is given.

### ***Theoretical frame: management of common pool resources from the perspective of New Institutional Economics (NIE) (Chapter BII)***

The theoretical frame of the thesis are the findings of New Institutional Economics (NIE), especially Ostrom. Against the background of neoclassical economics the scientific progress of the view of informal and formal institutions in terms of explanation of using systems of common pool resources is presented. The background of NIE is described in detail (mainly referring to Ostrom) and serve for the development of a model of rangeland management in Iran. Property in-use regimes (PURs) are being structured by the so-called “action arena”, and are referred to the informal institutions associated with property rights. Empirically observable differences of local PURs are explained in terms of characteristics of the rangeland resources, the characteristics of the users’ groups, characteristics of the study villages and the given markets. The model serves as theoretical background for the following empirical studies.

### ***Reasons for choosing Semnan Province as research area***

The main criteria for the selection of Semnan Province as the research area were:

- Access and sufficient data information on ecological conditions of the rangelands including ecological quality
- An accessibility to a rich source of collected data since many research studies on Iranian rangelands have been conducted in this area

To get access and sufficient data information on ecological conditions of the rangelands in Iran is not trivial due to the difficulty of the large size of the rangelands. Therefore, accessibility to rich information on the ecological quality of investigated rangelands formed the main criteria for the site selection. For almost all of rangelands in the study area, information on the forage productivity in terms of grazing (carrying capacity)<sup>1</sup> was accessible through either Range Management Plans or Grazing Licenses. In addition, many research studies in Iranian rangelands, on the field of rangeland ecology were conducted in this area.

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<sup>1</sup> Carrying Capacity is a technical term that addresses the potential stocking rate of pastures in a community measured as either the number of hectares needed to support one animal unit or number of animal unites could be supported by one hectare during the course of one year McCarthy, N., A. Janvry, et al. (1998). "Land Allocation under Dual Individual-Collective Use in Mexico." Journal of Development Economics **56**: 239-264..

The selection criteria were based on the Forest, Range and Watershed Management Organization<sup>2</sup>.

***The specified objectives of the case study are:***

- To analyse the diffusion process and the diffusion speed of the RMP in Semnan Province
- To describe the land parcels in Semnan Province and to identify the perception of the rangeland conditions and the purpose of land use from the perspective of the users
- To analyse the reaction of the nomads on Governmental campaigns
- To identify the type of the informal institutions currently applied in the study area
- To classify the applied property regimes based on the informal property institutions
- To identify factors that influence the applied regime
- To estimate the possibility of implementing the defined property regimes by the users 'groups

***Methods***

According to the research questions, different methods were used for collecting data and data analysis: literature review (scientific papers from different disciplines on the use and management of rangeland of Semnan Province but also other regions in Iran for the comparison of results), document analysis (mainly official statistics such as excel data files and documents), methods of quantitative social research such as interviews and descriptive statistics as well as methods of qualitative social research.

***Results from the first part of the case study: diffusion process of the governmental policy instruments - the rangeland management plan (RMP) and Grazing Licences (GL) (Chapter C IV)***

This chapter starts with a description of the diffusion process of the RMP in the study area. Having the analysis of regional differences, the *Bass model*, derived from the theory of diffusion, is applied (see also chapter B II 4.1). The Bass model

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<sup>2</sup> Moasessye tahghighat Jangal, Marta & Ab-khizdari

is used to estimate the coefficients related to the rates of adoption of the two study areas Semnan and Damghan to the RMP. The model describes the diffusion speed, at which the potential adopters implement the innovation. The speed is estimated via two coefficients

- *coefficient  $p$*  measuring the individual tendency to apply the innovation
- *coefficient  $q$*  measuring the influence of the former adopters on the potential adopters' to apply the innovation

***Results from the second part of the case study: attitude and perception of local users of the rangelands towards the governmental policy instruments RMP and GL (Chapter C V)***

This chapter starts with a description of the land parcels in Semnan Province which are used for the analysis of the users' perspective towards the RMP. The study sample is described in terms of socio-demographic characteristics of the respondents ( $n = 70$ ). The users perspective of rangeland is presented in terms of landholders perception of the rangeland conditions and the purpose of land use. Several attributes are identified from the perspective of the users:

- advantages such as determination of land boundary
- disadvantages such as lack of accessibility, high adjustment costs and reduced income
- compatibility such as match of the plan with the local knowledge
- observability such as visible effects of the plan
- other factors such as drought and trust about the state system
- common ownership such as privatization

The chapter ends with a discussion on the main findings.

***Results from the third part of the case study: The currently applied informal institutions (Chapter C VI)***

Chapter six starts with an overview of the history of rangeland management in the study area. Governmental campaigns and the reaction of the nomads on these campaigns are described. The analysis of current informal institutions results in the identification of reasons for rule establishment and the existence of sanctions. The institutions for the study region are identified as *strategies*. The chapter ends with a conclusion of the main findings.

### ***Results from part four of the case study: Current Property in-use regimes in Semnan Province (Chapter C VII)***

This chapter begins with the classification of the identified informal strategies. The classification results in property in-use strategies, production in-use strategies and exclusion in-use strategies. Each strategy is described in detail in relation to the aim of the establishment. Paying attention to the group-established property strategies, the whole implemented system is called property in-use regime (PUR) because the groups are governors on the study parcels of rangeland. The four identified regimes are

- the unregulated common property regime (UCPR)
- the common property regime with rotational access (CR)
- the common property regime with a unique decision maker (CU)
- Mini CPR within CPR (Mini)

In the following section, influential factors on the applied property in-use regimes are being identified. The influential factors are resource characteristics, village characteristics and group characteristics. In order to develop an indicator for the resource characteristics a factor analysis is being conducted on variables related to ecological conditions of the rangeland. For the group characteristics, in addition to the relevant theoretical variables, the “sources of income” and “living location” are found through the exploratory survey. The cluster analysis was used to distinguish various patterns in the “group characteristics” and “village characteristics”. An ANOVA analysis was conducted to examine the differences among the PURs in terms of “resource characteristics” (winter, summer and spring rangeland), “group characteristics” (demographic variables of age, education, income, flock size, heterogeneity in age and heterogeneity in flock), and “village characteristics” (type of the village, city and population density).

The last part of chapter seven presents the model of property in use regimes in Semnan Province. The model includes the three scopes of characteristics identified in the previous section. The resource characteristics include factors for winter, summer and spring rangelands. The group characteristics include the variables such as age, occupation, flock size and the living location. The village characteristics include the variables such as population density, the type of village, and city. A multinomial logit regression is used to estimate the probability of selecting a property in use regime by the rangeland holders. The key variables



are found “population density”, “heterogeneity in flock size” and “spring rangelands”.

### ***Conclusion***

The empirical results of Semnan rangelands reveal that RMP holders developed their own regulations. A major part of local institutions associated with rangeland management are still in the form of strategies and have not been internalized as norms. It can be concluded that the local institutions *are still in transition*. This can be seen as a great chance due to they have the opportunity to improve the existing institutions associated with rangeland management, or even to establish new institutional rules.

The study reveals several reasons for not implementing the RMP regulations

- non visibility of potential outcomes and benefits
- lack of knowledge about the plan
- lack of trust in the government and type of ownership
- the problem of drought in some areas of the study region

Proposed solutions to the non visibility of potential outcomes and benefits as well as the lack of knowledge about the plan are to provide information. These should be distributed among the local population e.g. through information campaigns. Public ceremonies should be established to make sure that the local population has access to this information. Training sessions, TV and radio programs, symbolic ceremonies and organization of cooperative groups are proposed as well (Hejazi 2007).

According to the literature, a solution to the problem of rangeland degradation might be privatization. However, the rangeland holders did not present a dramatic interest in privatizing rangelands. But it was found that the interest of rangeland holders for privatizing summer lands was greater than for the winter lands or spring lands. However, reasons for this preference could not be identified in this study.

Due to the frequent event of drought in some areas of the study region, it is recommended to conduct an in-deep monitoring of specific drought cycles as well as the long-term impact of droughts on dynamic of property regimes. With consideration to the fact that locating in the non-equilibrium environment is a major concern for all rangelands in arid and semi-arid regions, it is strongly recommended to investigate whether the Iranian rangelands meet the non-equilibrium conditions. If the conditions of the non-equilibrium do not meet, the drought management should be still the basic purpose of any improvement program.

An alternative to the policies of the government might be a self-regulated system. Even if the common nature of rangeland resources, the diversity of interests of the local users, and the transaction costs of negotiation might be a challenge in a self-regulated system (Houtte A.V. 2001; Macadam R. and Drinan J. 2004; McAdams and Rasmusen 2007), applying this policy is still an effective option. Implementation of this system requires the government to support the rangeland holders in establishing their own system, and provide them with some facilities in which they have difficulty, such as establishing enforcement system, sanctions and provision of necessary information. By applying this policy, the needs of the rangeland holders, such as changes in the income situation e.g. getting cheaper loans for equipment or finding additional occupation opportunities to should be considered. The lack of trust towards the government supports the suggestion for the implementation of this policy.





# **A Introduction**

# **1 Definition of rangelands**

The identifying characteristics of rangeland have been specified by numerous definitions over the past few decades. According to Harrington *et al*'s definition (Harrington, Wilson et al. 1984), rangelands are semi-natural landscape in which man attempts to earn a productive output by simply putting in domestic livestock to this ecosystem. Heady (Heady 1975) defined rangelands as "shrub lands, grasslands and open forests, where dry, saline or wet soils, steep topography and rocks preclude the growing of commercial farm and forest crops." (Van Gils 1984) presented another definition of rangeland "a tract of land currently used for grazing by domestic livestock and/or wildlife, where no mineral fertilizers are applied; semi-natural vegetation is the main forage resource and the stocking density is lower than one Animal Unit (equal to 250 kg live weight) per hectare per year." A more common definition of rangeland stated by the American society for range management (quoted from McGuire 1978) as "lands on which the native vegetation is predominantly grasses, grass like plants, forbs or shrubs suitable for grazing or browsing use which includes lands revegetated naturally or artificially to provide a forage cover that is managed like native vegetation." Despite the variation in these definitions and the fact that definition of rangeland in a given continent differs somehow from the others, there is a consensus that most of the rangelands in the world are located in semi-dry landscapes where agricultural activities may not be dominant land use due to either low or variable rainfall.

## **2 The importance of rangelands in Iran**

### **2.1 Total rangeland area in Iran**

There are varying estimations of the total rangeland area in Iran. For instance, in 1980, Bavari (cited in FAO 2004a) estimated 10 million hectares of the country land as rangelands, while it was estimated approximately 106 million hectares by (Sheidaei and Nemati 1978). An imprecise definition of the term rangeland can be attributed to the large uncertainty of Iran's rangeland area. The first reliable estimate of the area was presented by Niknam (quoted from FAO 2004a), who developed a map based on the definition of rangeland as stated in the forest and range exploitation law. According to this definition all lands apart from fallows, consist of mountains, hillsides and flat plains, covered by natural vegetation

during grazing season and traditionally recognized are defined as rangelands. The estimate of the rangeland area by Niknam was adjusted to 90 million hectares by satellite images taken by an American company, FMC. According to this definition used in the recent studies, rangelands occupy nearly 54.6 percent of the total land area and 65 percent of natural resources<sup>3</sup> in Iran (Badripour, Eskandari et al. 2006). They are largest terrestrial ecosystem in the country, thus playing important role in the economy of the country by providing ecological goods (Ghafari 1991b).

## 2.2 Economical role of rangelands in Iran

### *Overview*

Rangelands contribute to meat production, as well as providing medical plants and herbs. Range and livestock production makes up about one-third of income earned in the agricultural sector—which itself is about 20 percent of the total non-oil GDP (FAO 2004a)—and about 6 percent of the total GDP. Table 1 illustrates contribution of livestock production to the total GDP.

Items	1998/99	1999/2000	2000/01	2001/02	2002/03
% non-oil GDP to the total GDP	91.9	92.4	90.9	91.6	91.0
% livestock production to the total GDP	6.4	5.7	5.5	5.5	5.4

**Table 1 Contribution of livestock production to the Non-Oil Production (Source International Monetary Fund 2003, pp.280)**

For many pastoralists, rangelands are the major or only source of income, especially for those at the subsistence level (Farahpour 2002). This sector provides income to about three million households consisting of nearly 3 million people for whom livestock production is the sole source of income (Badripour, Eskandari et al. 2006).

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<sup>3</sup> Natural resources in this content are composed of rangeland, forest and desert.

### ***Forage and meat production***

In Iran, animal husbandry is the most productive use of the semi-arid zones bordering the desert (Reed& Bert, 1995; Seligman, 1992). Despite rangeland degradation in the recent decades, significant parts of fodder and subsequent meat production are still provided by rangelands. The amount of forage consumption varies depending on the production system of the rangeland. Therefore, the average proportion of rangeland consumption compared to the use of other fodder resources for some types of livestock, such as goats and sheep, is about eight to one<sup>4</sup> (Technical Office of Rangeland 2001), which demonstrates the magnitude of the demand on rangelands to maintain the livestock needs. Table 2 illustrates the total amount of produced fodder from different resources and their contribution to feed livestock.

Source of fodder	Production (1,000 tons TDN)	Contribution %
Fodder plants	4,155	17.5
Crop residues	7,322	30.8
Agro-industrial products	6,394	26.9
Range forage	5,885	24.8

**Table 2: Contribution of different sources of fodder production in Iran in 1999**  
(Source FAO 2004a)

According to Fazilati & Eraghi (1984)<sup>5</sup>, rangelands with 10 million tones of annual dry matter production produce 31 percent of the country's meat and 11 percent of milk production.

According to Badripour, Eskandari *et al.* (2006), livestock population over the country is about 124 million animal units. 83 million of the total livestock population depends entirely on the rangelands for seven months. Table 3 and

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<sup>4</sup> This figure refers to amount of range forage consumption for sheep and goat, while the figure on the table refers to all types of livestock

<sup>5</sup> cited in Farahpour, M. (2002). A Planning Support System for Rangeland Allocation in Iran. Case of Chadegan Sub-region. Department of Soil Science and Plant Nutrition. Wageningen, Wageningen Agricultural University.



Table 4 illustrate composition of the total livestock and of the rangeland-dependent livestock, respectively.

Type of livestock	Population (1.000 heads)	Coefficient to AU <sup>6</sup>	Equivalent population (1000 AU)
Sheep	54,000	1	54,000
Goat	25,757	0.75	19,318
Native cattle <sup>7</sup>	5,500	4	22,000
Hybrid cattle <sup>8</sup>	1,806	6.5	11,739
Pure cattle <sup>9</sup>	741.5	9.5	7,044
Camel	143	5.5	786
Buffalo	475	6.5	3,087
Draughts	1,727	3.5	6,044
Total			124,000

**Table 3: Composition of livestock population in 2001 (Source Badripour, Eskandari et al. 2006)**

Livestock	Dependent population on rangeland (1000 AU)	Coefficient to AU	Livestock dependency on the rangelands during one year	Feed requirements for one animal unit (kg T.D.N <sup>1</sup> )	Total feed requirements during dependency on rangelands (1000 tons T.D.N.)	Dependent livestock on rangeland during seven months based on feed requirements
Rural sheep	41,000	1	54	276.5	6,121.71	38,360
Mobile pastoral sheep	13,000	1	70	276.5	2,516.15	15,760
Rural goat	12,877.5	0.75	65	276.5	2,314.41	14,500

<sup>6</sup> Is a coefficient by which one head of the given livestock converted to Animal Unite (AU), which is an average adult sheep weighting 45 kg.

<sup>7</sup> A native cattle in this content is a foreign cattle that was not hybridized by Iranian species. The most common native cattle in Iran are Holstein from Germany and Netherlands.

<sup>8</sup> A hybrid in this content is a foreign cattle which was hybridized by Iranian cattle.

<sup>9</sup> A pure cattle in this content is a local cattle from s special region of Iran which was not hybridized by foreign cattle.

Continued table

Livestock	Dependent population on rangeland (1000 AU)	Coefficient to AU	Livestock dependency on the rangelands during one year	Feed requirements for one animal unit (kg T.D.N <sup>1</sup> )	Total feed requirements during dependency on rangelands (1000 tons T.D.N.)	Dependent livestock on rangeland during seven months based on feed requirements
Mobile pastoral goat	6,440	0.75	80	276.5	1,424.53	8,930
Rural native cattle	12,588	4	10	276.5	348.06	2,180
Rural and mobile pastoral camel	786.5	5.5	90	276.5	195.72	1,230
Rural and mobile pastoral draughts such as donkeys and horses	6,044.5	3.5	20	276.5	334.26	2,090
Total	92,736.5				13,254.84	83,050

<sup>1</sup> Total Digestible Nutrient

**Table 4: Composition of livestock dependent on Iranian rangelands for seven months a year (Source Badripour, Eskandari et al. 2006)**

### ***Medical and industrial production of the rangelands***

Rangelands have long been used as a source of medicinal plants. For example, *Ferula Gummosa* is an Iranian wild plant, covering over 700,000 hectares of the Iranian rangelands. It grows in the northern and western rangelands of the country at an altitude of 2000-4000 m with average annual precipitation of 250-500 mm. The density of the plant is closely linked to the winter rain and snowfalls. In many low altitude regions, especially in dry mountain ranges, the plant has disappeared (Thomsen, Schmidt et al. 2004). The plant, especially its root, produces two forms of saps, soft and hard. The gummy resin made from saps is used for industrial

products, as flavor enhancers in the food industry or as glue for gems like diamonds. The resin is also used in manufacturing stabilizing substances in makeup and perfume products (Mortazaienezhad and Sadeghian 2006). France, especially the perfume company of Dior, is a main customer of the resin produced by Iran (Thomsen, Schmidt et al. 2004). In 1996 and 1998, 15 and 27 tons of galbanum were exported, mainly to European market (Thomsen, Schmidt et al. 2004), at a value of 180,000 USD in 1998 to the country. The amount of harvested medicinal plants in 1989-1993 was approximately 39,000 tons equal to 77.7 million USD (FAO 2004a).

*Gum Tragacanth*, or goat thorn (Katira in Arabic and Farsi), is another natural and wild plant that was initially discovered in the desert highlands of Northern and Western of Iran. Iran is a major producer of this plant (FAO 2001) and rangelands produce a significant amount of this gum (Ghafari 1991a). The gum is a mixture of various species, including, but not limited to *Astragalus adscendens*, and *Astragalus gummifer*. The gum absorbs water and a part of it forms a miscible substance, while the other part forms a kind of gel. Both two substances have wide applications in pharmaceuticals and industry including thickening ingredients for some sorts of foods, syrups, dressing etc. (Gentry 1990). According to International Monetary Fund (2003), between 1998 and 2002 the value of exported *Gum Tragacanth* was yearly about US\$ 2million which comprised between 0.06 percent and 0.04 percent of the total Non-Oil Exports. In the recent years, some NGOs and governmental organizations have been researching on ways of exploitation of side products from rangelands. They also distributed brochures among rangeland holders to show how to exploit this plant, effectively. Grazing permit holders are officially allowed to exploit secondary products of rangelands, however they can not legally sell the permission to others (Badripour, Eskandari et al. 2006).

### ***Honey production***

Most of the rangelands include plants suitable for honey production. Honey from the rangelands is considered to be of a very high quality compared to other sources. Most of the rangelands used for honey production are either summer lands or corridor lands (defined below). In 1983, rangelands contributed about 13 million USD to the GNP value by producing 13 thousands tons of honey (Ghafari Spring 1991).

## 2.3 Ecological roles of the rangeland

Rangelands plant cover in arid and semi-arid environments, where there is a high likelihood of floods, and acts as a safeguard against soil erosion from flooding, or wind (Ghafari 1991b). Furthermore, Iranian rangelands are important in terms of bio-diversity and rare species including *Stipa barbata*, *Artemisia herbaalba*, *Poa bulbosa*, *Carex stenophylla* and *Noea macronat* (Taeb 1996). In addition, rangelands' vegetation serve as a carbon sink<sup>10</sup>.

According to a study conducted by Eskandari Shiri (2005 cited in Badripour, Eskandari et al. 2006) on economizing the ecological value of one hectare of rangeland, 75 percent<sup>11</sup> of the economic value of one hectare of rangeland was attributed to environmental services and the remaining to grazing products. Table 5 represents details of economic value of one hectare of rangeland.

Items	Values in US\$
Greenhouse gases	7
Regulation of water cycle	3
Erosion control	27
Soil formation	1
Pollution control	87
Pollination	25
Biological control	23
Production of raw material (grazing products)	57
Recreation	2
Total	232

**Table 5: Economic value of one hectare of rangeland (Source Eskandari Shiri, 2005 cited in Badripour, Eskandari et al. 2006)**

<sup>10</sup> As rangeland vegetation grows and increases their biomass, they absorb carbon from the atmosphere and store it in their plant tissue. The process is known as sequestration and the quantity of carbon maintained in the live vegetation is known as carbon store. Carbon sequestration reduces the rate at which carbon dioxide accumulates in the atmosphere, and thus protects it from climatic change.

<sup>11</sup> Is equal to 174 US\$

### **3 Rangeland degradation**

The rangeland of Iran has been degrading for many decades (Eskandari Z. & Chavoshi S. 2002; Tavakoli M. & Ghodoosi J. 2002; Hedjazi 2007). According to Farahpour M., H. et al. 2004 and Badripour, Eskandari et al. 2006 the main factors that generate these issues are:

#### ***Untimely grazing***

Untimely grazing can occur in the form of “late grazing” and “early grazing.” The “late grazing” happens when herders take their livestock on the rangeland after seeds have grown to maturity and the maximum period of warm season plant growth has ended. At this time the produced seeds that need for the following year’s forage growth can be trampled into the ground or eaten by livestock. The “late grazing” has been very rarely seen on the Iranian rangelands (Badripour, Eskandari et al. 2006). The “early grazing” happens when herders introduce their livestock on the rangeland before forage plants have grown to maturity. Early grazing causes the immature plants to be killed, and thus a reduction in forage production as well as damage to native rangeland, and gradually degrades the rangeland area. The “early grazing” is an important cause of rangeland degradation for the Iranian rangelands (Ayorlo M. 2005; HajiRahimi and Ghaderzadeh 2008). There are a number of factors, which may create incentives for early grazing (Badripour, Eskandari et al. 2006):

- Competition among land users.
- Scarcity of forage for the period of time between winter and summer seasons.
- Climatic uncertainty.
- Introduction of transportation technology that speeds up production.

#### ***Overgrazing***

Overgrazing occurs when the continued heavy grazing exceeds the recovery capacity of the forage plants. The overgrazing can occur because of an excessively long duration of grazing (overexploitation), or having too many livestock feeding on the rangelands (overstocking) (Vallentine J.F. 2001).

#### ***Overexploitation***

This happens when the herders keep their livestock on a rangeland after the sustainable amount of forage resources has been removed. In this case, the roots

do not have enough time to recover. In the situation of the overexploitation, a sustainable number of livestock stay on a rangeland for an excessively long period of time.

The main reason for overexploitation of Iranian rangeland seems to be that the grazing permits for winter pasture often expire before the permit for summer pasture becomes operational. Therefore, herders are confronted by fodder scarcity. They are forced to stay in one place without having grazing permits, or seek for alternatives, for instance dried fodder. Herders prefer to stay in either winter or summer pastures since, the cost of dried fodder, which accounts for more than 90 percent of livestock costs, is so high, and there is a low likelihood of being caught and fined as a result of weak monitoring and enforcing systems.

### ***Overstocking***

This occurs when too many livestock graze on a unit of rangeland for a certain period of time. The severity of forage grazing damages the vegetation cover and causes rangeland degradation.

According to the governmental definition of overgrazing (Badripour, Eskandari et al. 2006), the following items have been defined as influencing factors:

- Massive increases in the number of livestock
- Lengthening the time the animals stay in a specific area of the pasture
- Underutilized grazing: the scarcity and poor quality of water resources are the main obstacles to regular grazing

## **4 Range management plans (RMP) as management tools for adjustment**

For the first time in 1967, rangeland management was taken into account in the governmental sector and the structure of forest organization expanded to several offices, including the rangeland office to deal with the previously mentioned issues (Badripour, Eskandari et al. 2006). To improve the condition of the rangelands, the Iranian government has launched a national policy for regulating the use of the rangeland resources. The Rangeland Management Plans (RMP), is designed with the principles of plant ecology, and based on the range succession model. According to this model, a given rangeland has an ecologically tenacious status in the absence of grazing. The model indicates that ecological changes in the stable status of the rangelands due to grazing pressure are again stabilized by

successional tendency of vegetation. Therefore, based on the model the main approach to effectively manage the rangelands is to select a stocking rate that creates a long-term balance between the grazing pressure and the successional tendency (Westoby, Walker et al. 1989; Azadi, Shahvali et al. 2007).

Boundaries of the rangeland, grazing capacity and grazing seasons are made the main structure of the RMP; however the instruction becomes a bite broader to management strategies. For instance, range management plan defines the grazing system - rotational or paddock - and rehabilitation programs that are suppose to be implemented for a specific area (Badripour, Eskandari et al. 2006).

## **5 Problem Statement and Research Questions**

Despite of nearly 25 years of implementation of the RMPs, the population of livestock is still about 2.5 more than the carrying capacity defined by the plans (Badripour, Eskandari et al. 2006).

Although the ecological benefits of implementing the defined plans to the rangeland vegetation has been highlighted (Arzani, Azarnivand et al. 2007); evidence illustrates that many landholders have not gone through the sustainable management system defined by the government (Hedjazi 2007).

The formal rules defined by the government are the same for almost all groups of landholders; however, some groups have already established their own rules to manage their common lands. The local rules hypothetically play a very important role in following the defined regulations on rangeland management by the rangeland holders. Nonetheless, some characteristics of the society as well as rangeland resources may contribute to establishing the local rules and regulations.

The central objectives of this thesis are

- to describe the systems of rangeland management in Iran as they are observable in the practise and
- to find explanations for the common and critical overuse of rangeland from the perspective of governmental institutions and the local users.

The following two research approaches are used to answer these central objectives:

- Based on the theories of New Institutional Economics, especially the scientific findings of Elenor Ostrom and an extensive socio-economic analysis of land use in Iran, the theoretical framework for the empirical

study is developed in **chapter B**. This framework presents the overuse of rangelands as effect of local behaviour of users who do not have the opportunity to directly influence the societal conditions, the characteristics of resources and cultural traditions.

- Based on this theoretical framework, **chapter C** presents the empirical case study to describe and explain the different land use regimes in Semnan Province.

In **chapter D**, the results from the predominantly literature based analysis of socio-economic conditions in Semnan Province are connected with results from the empirical case study. Conclusions for rangeland management in Iran are drawn and open research questions/recommended further research are/is specified.



## **B Rangeland Management in Iran – a Socio-Economic Analysis**

# **I Literature Review: Problems of Rangeland Management in Iran**

## **1 Ecological characteristics of Iranian rangeland**

### **1.1 Geographical and topographical feature of the country**

Iran covers a land area of 1.64 km<sup>2</sup> that is attributed to an alpine country. The average altitude of the country is about 1,250 meters. More than half of the country is located at the altitudes between 1,000 and 2,000 meters, while 16 percent of the area is at the altitudes above 2000 meters that also include some mountains of 3,000 to 4,000 meters. The peak of Damavand is the highest area of the country, even in West Asia and Europe. The Dasht-e-Lute in the central plateau—156 meters below the sea level—is the lowest point of the country. Table 6 illustrates percentages of different levels of altitudes in the country.

Altitude (meters)	Area (km <sup>2</sup> )	Percentage
Over 2000	260,000	15.7
1000-2000	879,000	53.3
500-1000	154,000	9.3
0-500	332,000	20
Below the sea level	11,000	0.9
Water land above the sea level	14,000	0.7
Total	1,650,000	100

**Table 6: Percentages of different levels of altitudes in the country** Source (Behzad and Badripour 2007)

Topography influences climate and soil structure, and thus it is one of the main attributes that determines the vegetation zones. Steppe and desert vegetation that cover the center of the country are mainly created by the “V shaped” form of the

mountain chain of Alborz and Zagross. This prevents humid winds of southwest from arriving to the central part of the country. Therefore, different types of climate and vegetation, as a result of great variation in altitude, are found over relatively short distances.

## **1.2 Climate and drought**

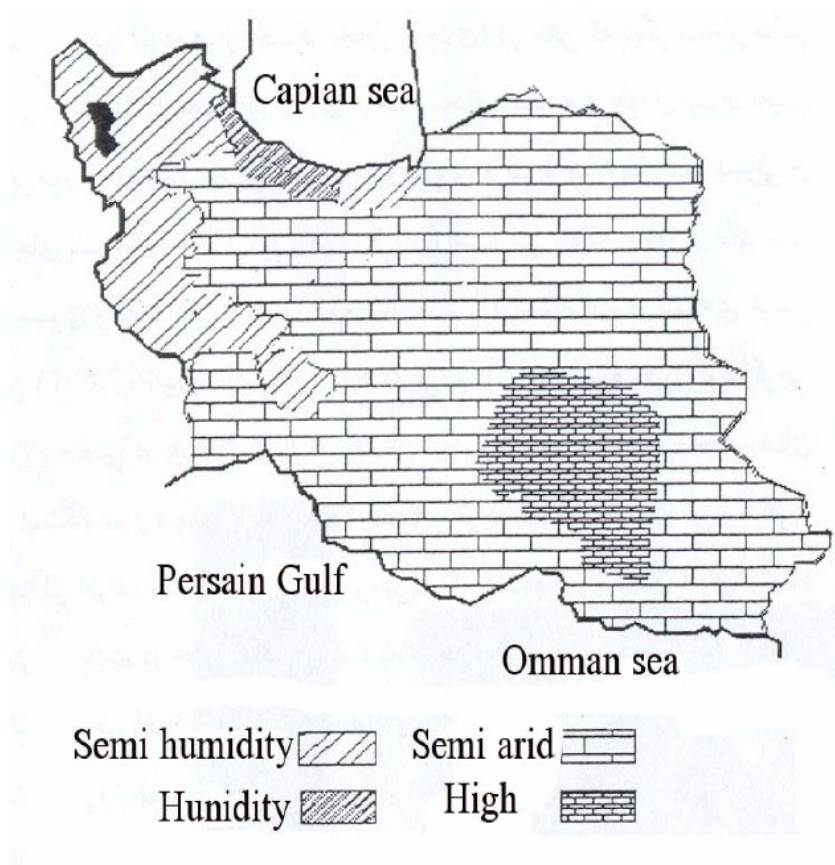
Iran is located in an arid zone. Nearly 85 percent of the country is situated in arid, semi-arid or hyper arid environment. The country temperature ranges from  $-20\text{ }^{\circ}\text{C}$  to greater than  $50\text{ }^{\circ}\text{C}$ , and receives less than a third of the world average precipitation. The mean annual rainfall is about 246 mm. Two major mountain ranges (the Zagross chains in the west and the Alborze in the north) influence the country climate by preventing humid clouds from reaching central, eastern and southern parts. Therefore, the central, southern low lands and eastern parts of the country receive low precipitation with a high variation (FAO 2001).

The maximum perception is 1200 mm in the north and 100 mm in minimum in the central area of the country. Figure 1 shows distribution of different areas of Iran in terms of humidity.

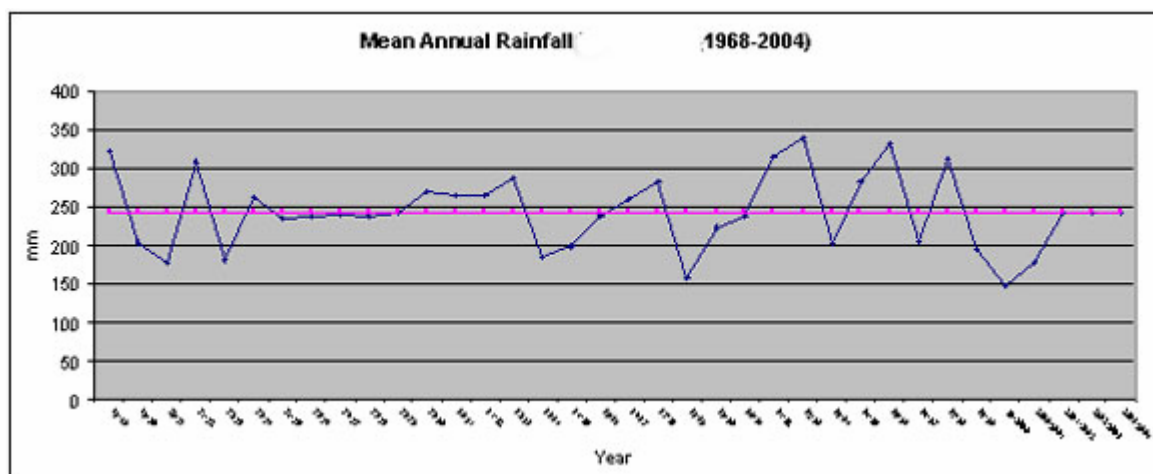
Drought<sup>12</sup> is a common issue in Iran. During the past 36 years, the country has suffered severe droughts for six years (1997-2003). According to (Shahbazbegian M. & Bagheri A. 2010), the probability of a severe drought is once in 30 years. Each year the drought became less severe in its duration. Nevertheless, the social and economic impact was significant, especially for farmers and pastoralists. For instance, during the last drought between 1997 to 2003, 75 million animals of 90 million animals was affected, while immediate small stock loses were about 800,000 animals. Additionally, the drought reduced the source of pastoral income by decline in animal prices at the same time that the price of important staples such as flour increased. Figure 2 illustrates mean annual rainfall of the country from 1968 to 2004.

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<sup>12</sup>There are several definitions for drought. In this study, drought means “a prolonged period of dry weather, generally when the precipitation is less than three-quarters of the average annual amount” (Kothmann 1974 cited in Badripour H. *et al* 2006).



**Figure 1: Distribution of different areas in Iran based on amount of humidity**



**Figure 2: Mean Annual Rainfall (1968-2004)** (Badripour, Eskandari et al. 2006)

### 1.3 Classification systems of Iranian Rangelands

Rangelands in Iran are classified on the basis of the time of grazing and ecological conditions that are significantly influenced by climate and amount of precipitation (Ghafari Spring 1991).

#### *Classification based on the time of grazing*

Based on grazing season, which is dramatically influenced by topographical and geographical characteristics of the area, Iranian rangelands are divided into three categories (TOR 2001):

##### **a. Alpine or summer grazing rangelands**

These rangelands are mostly located at high elevations, in particular the Albourz and Zagross Ranges with the height of 3,000 meters above sea level and 300-500 mm of annual precipitation. The growing period in these rangelands is very short (Badripour, Eskandari et al. 2006). Amount of forage production per hectare is about 580 kg of dry matter and depending on the location can be grazed for 3-4 months in the summer (CEP 2005). In total, these rangelands account for 15.5 percent (14 million hectares) of the total rangelands and produce 6.21 million tons of dry matter, supporting 45 million AU<sup>13</sup> for 100 days (Badripour, Eskandari et al. 2006). The general vegetation cover of rangelands in this area is a combination of soft herbs and grass species. These rangelands are in a fairly good condition (Farahpour 2002).

##### **b. Lowland and winter grazing rangelands**

Lowland and winter grazing rangelands are located in the low altitudes and flat plains. Due to the high temperatures in the winter season, plant growth occurs in the wintry months. Some of these rangelands are located in very low areas. The very hot summers are unsuitable for livestock product due to insufficient forage and scarcity of water (Badripour, Eskandari et al. 2006). The amount of forage production per hectare is about 184 kg of dry matter which is grazable from the middle of autumn to the beginning of spring for 42 days. The area of this kind of rangelands is about 66.7 percent (60 million hectares) of total rangelands,

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<sup>13</sup> Animal Unit (AU) is the feed and requirements of average adult sheep weighting 45 kg. Animal units for other kinds of common livestock in Iran is defined as :

a cow is equal to 5 AU; a camel is equal to 8 AU; a goat is equal to 0.8 AU

producing 4.49 million tons of dry matter in normal years (CEP 2005). These rangelands are dominated by shrub species. The overgrazing on these rangelands was reported (Farahpour 2002) more heavily than the previous group, therefore, their conditions are in fair.

### **c. Corridor lands**

These lands are located in the area between summer and winter rangelands. They are grazed between the winter lands to the summer lands. (Badripour, Eskandari et al. 2006). These rangelands occupy about 17.8 percent (16 million hectares) of the rangelands, producing 52.5 kg of dry matter per hectare that can be grazed in two time periods of a year (CEP 2005). Most corridor lands are close to the villages, therefore, they are most likely to be threatened by land use conversion (TOR 2001). Rangelands are generally in poor and unsatisfactory conditions, and thus exacerbate the practice of overgrazing (Farahpour 2002).

### ***Classification based on ecological condition***

This classification has four categories based on vegetation cover, vegetation composition, soil conservation and plant vigor (Ghafari Fall 1991).

#### **a. Excellent rangelands**

The percentage of vegetation cover in these lands is between 76 and 100 percent consisting of good quality species. The amount of precipitation in the area is above 500 mm producing yearly about 500 kg of dry matter (DM) per hectare. The grazing capacity for the whole year is one livestock unit-two livestock units for 100 days. The calculation is based on 2 kg of dry fodder per day per standard livestock unit.

#### **b. Good rangelands**

The plant vegetation cover in this area is between 51 and 75 percent. The amount of precipitation is above 400 mm producing yearly about 450 kg of dry matter (DM) per hectare. The grazing capacity for the whole year is 0.5 livestock units equal to one livestock units for 100 days. Most excellent and good rangelands are located in west of Iran.

#### **c. Fair rangelands**

The plant vegetation cover in this area is between 26 and 50 percent. The amount of precipitation is about 300 mm producing yearly about 350 kg of dry matter

(DM) per hectare. The grazing capacity for the whole year is 0.25 livestock units equal to 0.5 livestock units for 100 days.

#### **d. Poor and very poor rangelands**

The percentage of plant vegetation cover in this area is between 0 and 25 percent. The amount of precipitation is about 250 mm producing yearly about 250 kg of dry matter (DM) per hectare. The grazing capacity for the whole year is 0.125 livestock units equal to 0.25 livestock unit for 100 days. Most of the poor rangelands are located in the east of Iran. Table 7 illustrates amount of summer and winter rangelands with regard to their ecological condition.

Condition	Summer rangelands		Winter rangelands	
	Hectares	Percentage	Hectares	Percentage
Good	1,618,430	16	181,290	10.3
Medium	4,450,681	44	7,280,334	41.4
Poor and very poor	4,046,074	40	8,493,724	48.3
Total	10,115,185	100	17,585,348	100

**Table 7 Amount of summer and winter rangelands with regard to ecological condition** Source (Behzad and Badripour 2007)

## **2 Government's project in the recent year (after the Islamic Revolution in 1978)**

### **2.1 Overview: historical development of governmental policy**

After the Islamic revolution to 1984, the government took no action to the rangelands for some years. From 1984, as a result of accelerating rangeland degradation, the government considered rangeland management as one of the main programs of governmental instruction (Soltani 1990). As the first reaction, the government established the "Research Institute of Natural Resources" (Markaze Tahghighate Edare Manabe Tabi) in 1968 and gradually changed its name to the Research Institute of Forest and Rangelands (Moassesye Tahghighate

Jangalha & Marate) and expanded to nine institutes, including the Rangeland Office (Edare Marta) to deal with range problems (FAO 2001). In 1967, rangeland management was taken into account by the national government and the responsibility of rangeland protection and preservation was assigned to the Ministry of Natural Resources (Badripour, Eskandari et al. 2006).

Governmental reforms after 1984 present consist of local plans and national plans (Badripour, Eskandari et al. 2006). Local plans have been implemented in specific areas to test how similar the expected results are to the actual outcomes. The rule of sedentarization and the program of balancing livestock with grazing capacity are examples of this kind of regulations. National plans are those that applied for the entire rangelands of Iran. The most common examples are the Range Management Plans and the Grazing licenses.

## **2.2 Local Plans**

Local plans are used for a certain area to figure out the advantages and disadvantages of the plan implementation. Balancing livestock with grazing capacity and the program of sedentarization are examples of these plans.

### ***Balancing livestock with grazing capacity (BLGC)***

This program is designed to reduce the number of livestock by preparing sufficient circumstances for implementation of RMPs. The program began in 2001 with the collaboration of 155 rangeland holders in all areas who were named the plan's executives. Since the executives were considered to be earlier adopters, they had to have a high level of education and acceptable economic status to participate actively in the plan (Hedjazi 2007). The aim of the program is to change the hectares of rangelands, the number of livestock, and thus the annual revenue for each family household from the prevailing situation to a more suitable one (Abdolahpour 2001). According to a study conducted among 155 rangeland holders called as pioneer adopters of 15 provinces in Iran (Hedjazi 2007), BLGC has been relatively successful in terms of program compatibility with socio-cultural values and beliefs, previously introduced the idea and clients' needs for the innovation. In addition, the structure of the program was not problematic for the rangeland users and there was willingness among landholders to adopt the new rules of BLGC.



### ***The rule of sedentarization***

During the last decade when land degradation became an obvious ecological dilemma, sedentrization of nomadic communities began to be implemented to prevent the rangeland from degrading. This policy was tested in some regions. It was ended due to the following reasons:

- Mobility was the norm among nomads and was not easy to change.
- Although some communities were willing to settle, they were unable to maintain the new vocations have not been an appropriate replacement for the income from pastoralism.

In some areas, a great deal of government investment has gone to promoting the conversion of land use from livestock grazing to agricultural activities, in other words, converting experienced livestock managers into inexperienced farmers. It could be concluded that the first step of the program has not been highly successful due to converting land management from a resilient system to a fixed system of agriculture that causes increased economic risk for rural people.

There are three main kinds of sedentary livestock owners in Iran.

- The first group consists of individual households, and nomads with small groups of livestock up to 50 AU. They all have voluntarily settled. Almost all of them reside around water resources or fertilized land or other critical resources. Many of these systems have not been sustainable because they lack a sufficient economic base, and flexibility to deal with environmental uncertainties.
- The second group consists of households from the first group who were not able to remain in the villages, and move to the edges of the big cities. In this case, they still suffer from the lack of land allocation and sufficient economic base.
- The third group consists the nomadic communities who have been forced or encouraged to settle in villages. Some villages in Iran are the result of the government sedentarization efforts to over 40 years.

In each of the three groups, successful nomads were those who either had sufficient capital to transition from the traditional system to the new one, or have continued raising livestock in addition to agricultural activities. In the second

case, almost all of them converted the system of livestock management from nomad pastoralism to other types such as transhumance<sup>14</sup>.

### **2.3 Grazing License and Range Management Plan (RMP) as National Programs**

RMP was primarily considered by the government, even before the Islamic Revolution, as the best scheme to improve rangelands, but after a short term of implementation it was substituted to grazing licenses due to the small number of range experts and limited knowledge (BSDF 2001; FAO 2001; Badripour, Eskandari et al. 2006). A grazing license is still the first certification that gives a livestock holder an official right to use the land. It is also a pre-requisite for asking for RMP provided by the state (Badripour, Eskandari et al. 2006).

In 1959, the initial study on rangelands was carried out by FAO experts and in collaboration with Iranian scholars. It was focused on range ecology and identification of plant resources. In addition, degradation in Iranian rangelands was concluded by this study, leading to RMP implementation.

In 1967, after the establishment of the ministry of natural resources in Iran, the ministry decided to train staff in the area of natural resources, mainly forest and rangeland. In order to achieve this aim, academic fields were established within the University of Gorgan, and Dr. Goodwin, of Utah University organized an academic course of study in the field of rangeland management. In addition to university students, all staff members working for rangeland office at the Ministry of Natural Resources, participated in this course. In 1968 Dr. Goodwin taught a course called “management of private rangelands” whose learning materials was similar to the framework of RMP.

RMP aimed at improving rangeland condition based on the range succession model, which drives from plant ecology. According to the model, a given rangeland has an ecologically tenacious status in the absence of grazing. The model indicates that ecological changes in the stable status of the rangelands due to grazing pressure are stabilized by succession tendency of vegetation. Therefore, based on the model, the best approach to effective management is to select a stocking rate which creates a long-term balance between the grazing pressure and

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<sup>14</sup> Transhumance refers to regular migration between seasonal grazing areas.

the succession tendency (Westoby, Walker et al. 1989; Azadi, Shahvali et al. 2007).

### ***Structure of RMP***

In 1974, the structure of RMP was determined by the Technical Office of Rangeland (Behzad and Badripour 2007). The structure was prepared as forms and distributed in different provinces as a basis for RMP's preparation. Therefore, following information is found on a RMP, those include:

- Historical review of rangeland use.
- Information on practical and official number of livestock.
- Description of natural conditions. This includes climatic condition (rainfall, maximum and minimum temperatures), topography of area, and soil structure.
- Amount of forage production in the area such as vegetation cover, rangeland condition, and grazing capacity<sup>15</sup>.
- Water resources.
- Other usages of the rangeland such as harvesting medical plants.
- Rehabilitation programs.
- Grazing systems.
- Required financial facilities including both people and government investments.
- Economic analysis of the plan. Economic value of range forage produced by either plantation programs, or rehabilitation, and improvement programs consisted the main part of the analysis. Immeasurable factors such as land and water protection and improvement in economic situation of rangeland holder were disregarded.
- Recommendation and conclusion.

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<sup>15</sup> Grazing capacity indicates approximately number of livestock that a certain rangeland will sustain over time. To measure this indicator, amount of forage usable for livestock is calculated for one hectare, and then between 10% and 60% of the figure depending on the land condition is considered as the amount of forage harvested by livestock under sustainable condition. Consequently, A.U.M indicates average number of livestock (per hectare in a month) that will sustain the rangeland.

Management strategies including grazing system, rehabilitation programs and water harvesting programs is central to the RMP (Badripour, Eskandari et al. 2006).

*Grazing system.* The system of rotational grazing is often suggested by the RMPs to get optimal production. The technique is usually applied for mixed herds of sheep, goats and occasionally other animals. The system is based on the division of the entire area into smaller sections called paddocks. The animals are moved from one paddock to the next after a certain period of time. In many cases, one paddock, called “rest paddock” is not supposed to be used for the entire year. The RMP determines number, size and layout of paddocks, and when to move animals from one paddock to the next.

*Rehabilitation programs.* Direct seeding and hoeing-sowing of high quality range plants are the most common kinds of rehabilitation plans. In this project, palatable and valuable species that are adaptable to the range condition are sowed by the techniques of direct seeding (for flat areas with gentle slope) or hoeing-sowing of seeds (for mountainous areas with steep slopes). The seeds are provided by the government, and seeding and maintenance are the duty of the pastoralist.

*Water harvesting.* This program has been applied for areas with low vegetation cover, causing high surface runoff potential, that may result in flooding. Contour furrows, ditches and pitting along with seeding are the treatments that intended to protect the rangelands by utilizing surplus water for the development of plantation and vegetation cover.

*Water point construction for livestock.* In some areas, there are spots that are not utilizable, not because of forage shortage, but because of water scarcity. Improvement of water supplies carried out by making storage tanks, improvement of springs, providing troughs, drilling wells and installing windmills reduce overall grazing pressure through even distribution of livestock on the rangeland.

## **2.4 About RMP's implementation**

After introduction of RMP to the official system - both governments before and after Islamic Revolution - have not followed the same policy in dealing with RMP over the time. This part represents changes in government's policy in implementing and enforcing RMP.

### ***Before the Islamic Revolution***

The initial RMP was conducted in 1967 before Islamic Revolution in Iran. University students developed the plan with the assistance of rangeland experts from the United Nation as a practical training course. The plan was designed for 2000 hectares of rangelands located in Firskouh<sup>16</sup> and close to high road that was mentioned as the main reason for practical failure in RMP implementation.

The second RMP for Khlashkooh<sup>17</sup> in the Gilan province was carried out by university students as part of a MSc thesis under the supervision of Dr. Goodwin. Although Dr. Goodwin himself went to the area to manage plan's implementation, it practically failed due to conflicts between villagers and nomads about land ownership. Application of RMP with a large size of land did not succeed at the beginning.

Nevertheless, the Technical Office of Rangeland followed direction of **RMP with large size of land** for six years. In 1969, the Rangeland Office under the Ministry of Natural Resources dedicated a team of rangeland experts, including 13 people. Dr. Goodwin taught the team about evaluation and measurement of ecological condition of rangeland by using a four-factor method<sup>18</sup>. The team was sent to different provinces into three groups, in order to prepare RMPs for different areas<sup>19</sup>. None of the RMPs directed by the groups were practically implemented due to the large size of area, the large size of landholders, in some cases more than 20 people, wrong pre-assumption of participation of users' groups and preparation regardless of traditional boundaries of rangelands and traditional structure of users' groups (FAO 2001) Implementation of large RMP, which was started in 1975, suspended in 1975.

**Small RMPs** called "rehabilitation and improvement programs" (50-1000 hectares) were also conducted under governmental investment for some regions. Small RMPs were introduced by the Technical Office of Rangeland once the

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<sup>16</sup> Located in Albourz mountains, northeast of Iran

<sup>17</sup> The plan was conducted for 27,695 hectares of rangeland.

<sup>18</sup> Percentage of vegetation cover, vegetation composition, soil conservation and vigour of plants are 4 factors that have been considered to measure the grade of ecological condition of rangeland. . The maximum grade is 50. According to the grade calculated by this method, rangelands are categorized into 5 groups as follows: 40-50 excellent, 35-39 good, 30- 34 fair, 15- 29 poor, less than 15 very poor.

<sup>19</sup> Large RMPs were prepared for Zarand Save (191,026 hectares), Kordestan (86,000 hectares), Kerman (250,000 hectares), Sabzevar (82,000 hectares), Bakan plain in Fars Province (500,000 hectares), Garmsar (176,000 hectares) and Maghan & Sabalan (92,000hectares).

challenges to large RMPs had been specified. The main difference between small RMPs and large RMPs, in addition to the size of the land, was contract-making<sup>20</sup> between rangeland holders and the government. This contract was designed to ensure rangeland holders own their lands for relatively a long period of time (15 years). The change of large RMPs to small RMPs improved the rangeland holders' participation, and in less than two years 290 of RMPs were directed, following inquiries from rangeland holders who even paid for RMP's preparation. Therefore, smaller RMPs appear to be more successful, in terms of users' adoption, than the large ones (FAO 2001).

### ***After Islamic Revolution***

After the Islamic Revolution in 1979, direction of RMPs was suspended for 2 years, and instead the government considered forage plantation more important compared to RMPs' implementation. Distribution of grazing licenses among retail livestock holders and shepherds who had worked for major herders was another activity by the government. This action caused an increase in number of livestock holders<sup>21</sup>, and thus reduction in amount of rangeland per a rangeland holder. Over the two years, provision of an identity card for rangelands was the main focus of Natural Resource Organization. The following information was found in the identity cards:

- Physical boundary of the rangeland.
- Ecological and climatic information related to the rangeland.
- Optimal requirements to implement small RMPs.

In 1983 direction of RMPs were completely suspended; however after 1986 RMP became a main issue in the Technical Office of Rangeland followed by publishing a magazine called "people participation in rangelands' rehabilitation and improvement"<sup>22</sup> by the Technical Office of Rangeland. In this magazine, lack of rangeland holders' motivation to participate RMP, lack of people's confident of continuing the plans by the government and feeling unsecured by rangeland holders on maintaining ownership of their lands was mentioned the main causes of rangeland degradation over the country. In 1986, Technical Office of

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<sup>20</sup> Form of the contract used for the first cases is similar to the forms used currently, except for contract duration that has been changed from 15 years to 30 years.

<sup>21</sup> Increase in number of rangeland holders was started from the time of land reform. The law caused landlords to lose land security and sell their lands to retail livestock owners.

<sup>22</sup> Raveshe Mosharekate Mardom dar Eslah & Ehyae Marate.

Rangeland began directing RMPs; however implementation of RMP was not successful in the first years due to the transformation of responsibility of rangeland improvement plans from the Centre of Natural Resources to the Jihad Organization, increasing potential rangeland holders and renewing grazing licenses issued before the Islamic Revolution.

In 1986, the direction of RMP was begun by the Technical Office of Rangeland aimed at following purposes that were mentioned as main challenges to implementation of RMP.

- Definition of Rangeland holders' rights in the way that would not be damaged by changes in governmental rules.
- Establishment of sustainable management for rangelands.
- Increase in duration of RMP validation from 15 years to 30 years, in order to increase rangeland holders' confidence on maintaining their lands.
- Efforts to participate of rangeland holders in land investment. It was decided that the government provide the required inputs, while rangeland holders paid for implementing plans.

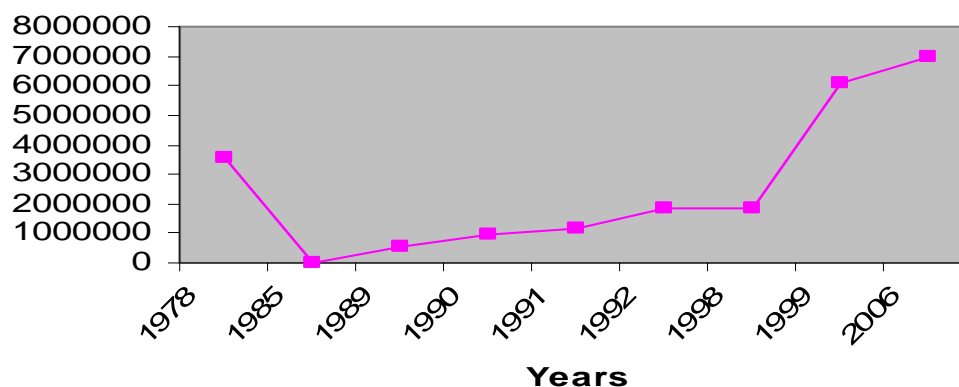
Over the last few decades, the government conducted following campaigns in order to encourage rangeland holders to RMP implementation.

- Land allocation for forage plantation to rangeland holders who implemented RMP.
- Transformation of responsibility of conducting rehabilitation and improvement programs from the government to rangeland holders.
- Provisions of financial facilities for rangeland holders in order to be able to invest in RMP.
- Provisions of information about RMP by the media

The following figure illustrates changes in direction of RMP by the government from the time of introduction (1967) till the recent years<sup>23</sup>.

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<sup>23</sup> As the graph illustrates the government has dramatically promoted the direction of RMP after 1998; while monitoring and enforcement of the directed RMPs remained very weak. Behzad, T. and H. Badripour (2007). *Modiriyate Chera & Chegoonegi Kooch ba Negareshe Jologiri az Cheraye Zood Hengam (Grazing Management and Mobility Circumstances with Regard to Protection from Early Grazing)*. Office of Rangeland (Daftare Omoor Marta). R. a. W. R. S. J. Organization of Forest, Marate & Abkhizdari Keshvar), Institute of Rehabilitation and Improvement (Gorooh Eslah & Ehya).



**Figure 3: Direction of RMP from the beginning till 2006 (Source Behzad and Badripour 2007)**

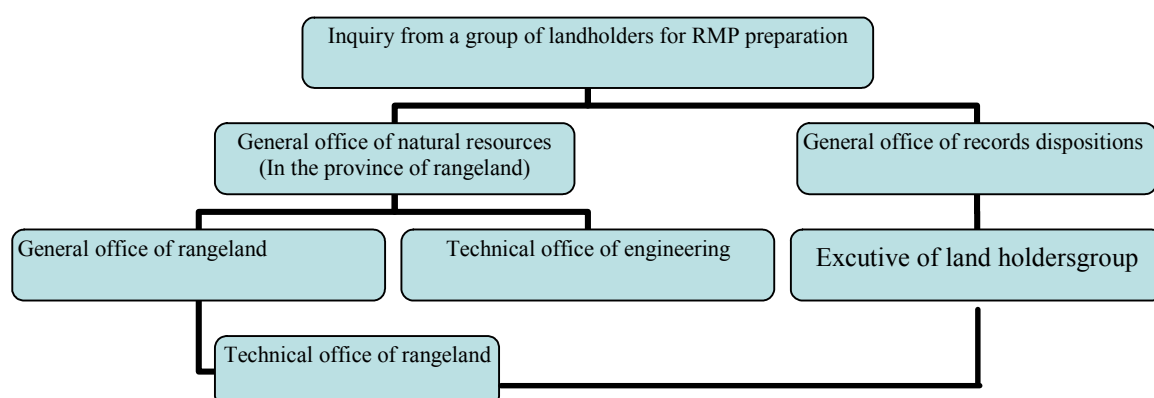
In 1994, the first socio-economic study on implementing RMP in two provinces of Fars and Kokilooye & Boyer-Ahmar was conducted by research centre of social science in Tehran University. According to this study, the forage product was increased up to three times in rangelands under RMP implementation. In addition, both quality and quantity of vegetation cover were significantly improved in rangelands under RMP. Furthermore, grazing management, compared to rehabilitation and plantation programs, played a more important role in rangeland improvement. Moreover, rangeland holders found RMP as the best solution to gain land ownership for a long period of time. It was found that rangeland holders who implement RMP have a much better economic situation, compared to those who did not use RMP. In addition, small RMPs was specified as more effective than large RMPs. Between one household to three households were specified as the optimal size for users 'group. The size of rangeland and livestock had to be 536 hectares and 299 AUs, in order to provide one household with living facilities. Provision of information about RMP's implementation through training classes and presents in the media increased rangeland holders' participation.

### ***Official process of RMP implementation***

After inquiry from a rangeland holder to the Office of Natural Resources for RMP implementation, the Engineering Office determines the physical boundaries of the



rangeland parcel<sup>24</sup>. Then, the General Office of Rangeland prepares a draft of RMP that will be evaluated by the Technical Office of Rangeland and the Council of Forest, Rangeland and Soil will conduct the final evaluation of RMP. If the council accepts RMP, the draft will be returned to the Technical Office of Rangeland and send to the General Office of Natural Resources to make a contract between an executive<sup>25</sup> of users' group and a representative of the Office of Rangeland. The Figure 4 represents official process of RMP's implementation:



**Figure 4: Official process of RMP preparation**

The utilization rights - based on these formulated plans - will be transferred to the livestock holders through formal long-term contracts, generally 30 years. If the instructions of the contract are followed properly, it will be extended for another term. Otherwise, the contract would be cancelled automatically and the livestock holders should leave the rangeland. According to the report (BSDF 2001), 9,900 rangeland management plans, covering about 23,000,000 hectares, have been prepared. Furthermore, 46 percent of the total rangelands are under the RMPs, while 51 percent under grazing license and only 3 percent without any official certification (Sanadgol 2008).

<sup>24</sup> called Saaman-Orfi that is a piece of land allocated to a users' group who are generally friendship to each other.

<sup>25</sup> Executive is an intermediary between the government and users' group

## 2.5 Grazing License

A grazing license defines the boundaries of the rangeland, grazing seasons, and grazing capacity for a household or, in most cases, for a group of households without specific boundaries for individual households.

In order to issue grazing licenses, the Natural Resource Organization established local offices in each area. The personnel of the relevant office visited the rangeland and delineated the grazing capacity as well as rangeland boundaries based on technical standard producer. To determine eligible users for a certain area of the rangelands, officials locally<sup>26</sup> asked the rural people to identify themselves if they are traditional users of the given rangeland. Then a team of officials went to the villages close to the land to assure the accuracy of the claims. After determining who was entitled to graze their animals, the office proposed a meeting with the traditional users to define the size of the share of each user on the basis of the traditional size of user's herd. A grazing permit was not issued for those who had fewer than 30 livestock <sup>27</sup> (Badripour, Eskandari et al. 2006).

Livestock owners, who hold a grazing license, have to follow the instruction of the grazing license, including number of livestock, time and period of grazing. In case of any offence, the license holder would be charged. For the first offence, the holder would be issued with a label showing a negative point. For the next time, his grazing right on that certain area would be withdrawn. A grazing license contains the following items:

- Photo of holder of the grazing license.
- Personal information.
- Name of the other holders who are allowed to take their livestock on the given area and the number of livestock they are permitted to bring.
- Rangeland geographical location, name, area of rangeland and boundary identification.
- Allowed number of livestock for the permit holder.
- Grazing time and grazing period.

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<sup>26</sup> Local announcements vary in different areas. In some villages, mosques play an important role on spreading news and announcements. Some large villages have local councils, mostly established by the government, to build a bridge between local people and the government. In many villages, strong friendship networks among local people help the government to spread announcements very fast.

In the initial years, grazing licenses were issued for a period of ten years. In year eleven, the land was evaluated and if the range condition had improved, the license was renewed for a period of thirty years. The holders annually renew their grazing license by paying a grazing fee of 800 Rials<sup>28</sup>. However, most grazing licenses are not renewed regularly due to the lack of adequate control over the rangelands (Badripour, Eskandari et al. 2006).

The main challenges to implementation of grazing licenses were the limited estimations of carrying capacity and enforcement of the imposed regulations. To estimate the carrying capacity of a given area, the range was supposed to be fully inventoried and evaluated. However, because of lack of time and money this process has not been implemented adequately. Therefore, in many cases, the permitted number of livestock exceeds the actual carrying capacity of the area (BSDF 2001). Furthermore, because of the vast extent and uneven distribution of the rangelands in Iran, it costs a lot for the government to control the size of livestock kept by herders. In most cases, livestock holders are able to keep as many livestock as they wish (FAO 2001).

## **2.6 Local system of rangeland management**

Although there is a single government policy for all rangelands in Iran, livestock holders actually apply different approaches to rangeland management on the ground. Local systems differ basically in the degree of dependency of livestock holders on the rangelands and mobility of livestock holders which are the basis for their categorizations into the three following groups (Amanolahi, 1960 cited in (Ghafari Spring 1991).

- *Full nomadism*: In this system, livestock provides the sole livelihood for nomads as “capital on the hoof”. Livestock owners travel long distances to find grazing. They comprise 2 % of the human population of Iran, and are gradually disappearing. The size of this group is gradually decreasing and is not so common in the recent years (Azadi 2005). Some do not have specific grazing areas for summer or winter. At present, about 2.6 % equal to 432.735 hectare of the agricultural lands in Iran is allocated to nomads. Almost all of these lands are

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<sup>27</sup> One of the purposes of the plan is to reduce grazing pressure on the rangelands that causes the right of livestock holders with less than 50 AU to be ignored.

<sup>28</sup> One Euro is equal to 1,400 Rials.

located in either summer or winter grounds. These lands are managed by about 100.000 nomadic households. Nearly 70 % of nomads own agricultural land either in winter or in summer lands, while 30 % have no agricultural land (Farahpour 2002). Nomads allocate about 68 % of their agricultural lands to annual crops, leaving the rest fallow. Most crops are cultivated under dry farming, with only 20 % of the total croplands under irrigation. Wheat and maize are the most common crops. In the lands under irrigation, the proportion of fodder products to the all crop production is about 12 %, and 11 % for garden, showing diverse composition of cultivated crops (Farahpour 2002).

- *Semi-nomadism* (Yaylaq pastoralism): This group also moves to grazing lands with their livestock during different periods of the year, but between two specific areas, one is used for summertime and the other is used for wintertime (Ghafari 1991a). They have either vertical mobility or horizontal movement. Vertical mobility is mostly used when the livestock holders move through the mountainous areas, while horizontal movement is mainly used when the herders move throughout the flat regions (FAO 2001).
- *Semi-sedentarism*: These groups settled in villages. However, during grazing seasons, they leave the village for the rich rangelands near their homes.
- *Transhumance*: In this system, owners and herders who live in the village employ a group of shepherds to take their livestock out to graze on natural rangelands.

Furthermore, with the introduction of the law of land reform in 1962, the traditional system which was upon the extensive use of rangeland resources through seasonal mobility was broken, and begun transforming to new systems (Baharvand 1983; Badripour, Eskandari et al. 2006; Cronin S. 2007). In addition to the law of land reform, some other factors were recognized to contribute to the creation of the new systems. The following part describes these factors in the more details.

### **3 Socio-economic factors influencing the transition to the new systems of rangeland management**

Although in 1962 the land reform law was the main basis for the transition from the traditional system of land management (nomadism) to the new one, some other internal factors in the communities have affected the process of transition.

#### ***Population growth***

Some scholars argue (Azadi 2005) that the increase in human population caused the traditional system to become unsustainable because the number of land users, and thus the number of livestock, began to grow. Some other (CENESTA Centre for Sustainable Development 2001) argue that:

“Traditional social rules prescribe intensity of land rules regardless to some extent of human population growth.” (CENESTA Centre for Sustainable Development, 2001, pp.4) .

According to evidence (Badripour, Eskandari et al. 2006), although the number of pastoralists’ households has risen, there are nonetheless fewer exploiters than there used to be. It shows that the “household dimension” of pastoralists has dropped.

#### ***Changes in the style of nomadic life***

According to Mosavinejad (1990), introduction of new approaches to managing natural lands such as improvement in agricultural species, also, entrance of imported products to the country have influenced the process of changes in the structure of nomadic communities.

#### ***New Approaches to management of environmental/climatic risk***

Given that the climatic condition and fodder productivity varies during different periods of time as well as from one place to another, nomads’ mobility is an approach to manage income uncertainty in the traditional system. This has changed with the development of new technology including veterinary medicines, heavy goods vehicles that cause management of climatic risk to be much easier.

#### ***Changes in economic structure***

In the traditional nomadic system, the main sources for feeding livestock have been rangelands, thus, the most efficient management of this system aimed at

reaching the best productivity of fodder. Therefore, the number of livestock grazing on rangelands in the traditional system was directly determined by the rangeland productivity. It could be concluded that the actual number of livestock and the grazing capacity of the area was in balance. The importance of pastures and rangelands has been falling as artificial methods such as cut and carry systems have been used. Rangeland and pasture currently are insignificant in comparison to the past with respect to their importance of feeding livestock. Furthermore, livestock rely on summer range more than winter range, as a result of accessibility to silage. This is particularly the case for villagers who raise livestock in addition to agricultural production. According to statistical figures estimated in 1986, only 25 percent of livestock feed has come from the pastures, in addition, food expense covered around 85 percent of the whole cost of keeping livestock. Although, the new system has reduced pasture production's share of livestock food production, this system has increased the pressure on the rangelands, which characterize good condition, in particular summer regions, and led to range degradation. For instance, the actual number of livestock in the western rangelands of Iran exceeds more than 8.5 times that of the potential grazing capacity (Farahpour 2002). That is because the productivity of rangeland is not the main determiner for the actual number of animals grazing the rangelands. Instead, herders increase their livestock because of other feed sources such as hay that compensate for productivity variation results from climatic changes.

### ***Changes in the purpose of livestock production***

The traditional system of livestock production was a closed economy in which the herds were considered as fixed capital and a part of livestock production such as milk, wool, met living needs of households and the surplus was sold in the local market. However, the closed economy of the traditional system has been replaced with the open economy resulting in changes in the economic and the social structure of the nomad community. In the current open economy, the main purpose of herders is increased meat production. This change in the purpose of raising livestock could be a result of an increasing demand for meat in comparison to other types of livestock products (Azadi, M. Shahvali et al. 2007), an increase in the human population and the accessibility to other sources of livestock feed. Consequently, the transition from a closed economy to an open economy could be have caused some of the changes in the lifestyle of households that could affect the system of rangeland management. These changes, however, have caused some

useful results such as an increase in livestock production, an expanded livestock market; that has resulted in some undesirable outcomes as well. For example, the ecological equilibrium that had been dominated under the traditional system is the main challenge to the new system. Consequently, in some scholar's point of view, these changes lead to the overuse of rangelands and degradation of pastures.

### ***Changes in the importance of ownership for herders***

In the traditional system of nomadism, land ownership was not as important as it is in the new system. After land reform, as the result of removed traditional rules upon rangeland exclusion, the sense of the importance of land ownership has been strengthened among nomads, while the problems of land degradation and scarcity of fodder production have been assumed to be the other motives for crop production, which led to privatization. According to Ghafari (1991b), more than 20 % of irrigation farming owned by nomads is allocated to fodder production.

### ***Changes in the social structure of nomad communities***

The major changes in the nomads' management of rangeland, as presented by evidence, can be categorized as the following:

- Tribal transhumance has changed to transhumance by small groups or individuals. Although the manner of seasonal movement of pastoralists depends significantly on the climatic circumstances of the area, and the social characters of the communities; 47.5 percent of pastoral mobility, according to evidence (TOR 2006), did individually. Only 8.3 percent of nomadic households moved over seasonal grounds in the form of tribal groups as occurred under the traditional system. It could be concluded that improvements in transport systems such as trucks influence systems of rangeland management.
- Changes in the community management: In the traditional system, the tribal chiefs were the main decision makers, while in the new system almost all decisions are made by household heads. For instance, as the evidence has shown, 36.7 percent of common decisions, including time and place of grazing, are made by the household heads, and not by the chief of the community. This new system made some obstacles to enforce and monitor the common rules.
- Changes in duration and ease of mobility: In the new system, almost 55 percent of pastoralists spend around 6 days to move between

summer grounds and winter grounds, while in the traditional system it took several months. This change has mostly occurred due to the introduction of new means of transportation.



## **II Theoretical Framework: Management of Common Pool Resources from a New Institutional Economics Point of View**

### **1 Aim of the theoretical framework**

While governments usually prescribe, through imposing requirements, approaches and methods that the rangeland users should - in theory - use. In practice, management of common-pool resources are different from the restrictions set by the governments. Many case studies demonstrate what causes the resource improvement or degradation are the approaches and techniques that the rangeland holders use in practice, and not what the government defines. Identifying the sources of rangeland degradation require understanding the behaviour that rangeland users applied in the real world.

Two economic theories - “Neoclassic Economics” and “New Institutional Economics (NIE)” are designed to describe and explain human behaviour. The two theories analyse the behaviours based on the human objectives, while the parameters of each theory vary.

The theoretical framework first aims to describe the two theories and their applications to the management of natural resources. The limitation of neoclassical theory will be discussed in chapter 2. NIE theory will be presented in detail (chapter 3). NIE later serves as theoretical frame for the case study Semnan Rangeland (chapter C).

### **2 About classical and neoclassical theory and management of common-pool resources**

#### **2.1 Classical theory - an initial to economical management of common resources**

To explain the causes of human behaviour related to the consumption of scarce resources, various theories have emerged through time. The classical theory is based on the concept of self-regulation. This theory came about during the period of shifting from feudalism to capitalism. As a response, people looked for their

own personal gains (Roemer 1988). According to the theory, in the world of economy any change in the equilibrium level of the economic system, such as amount of scarce resources, prices will automatically adjust by the market forces. The classical theory explains that prices will adjust in such a way that the economy will move to the equilibrium point over the long-term (Gordon 2000). The theory includes the following three elements: 1) the level of output at the level of Smith's "effectual demand", 2) technology, and 3) wages (Kurz & Salvadori 2003).

Additionally, the three principals of the free market include the "perfect market," "full employment level" and "very low impact of the government" that originate from the classical theory (Currie 1981). Although the theory is mainly connected to market operation, it looks briefly on the issues associated with property rights. The theory describes that the distribution of property rights of land and capital among individuals appears in the division of national income among labourers, landlords and capitalists in the form of wages, rent, and interest or profits (Heinrich 1997). While the theory is weak in the explanation of individual economic behaviour, it is still applied to macro-economic studies associated with distribution and utilization of wealth surpluses for luxury consumption and the problem associated with economic growth (Kurz & Salvadori 2003).

## **2.2 Neoclassical theory and management of common pool resources**

Neo-classical theory has been developed to explain the shortcomings of the classical theory about individual behaviour, particularly in relation to the allocation of the scarce resources. Nevertheless, the theory has been expanded on the core principals of the classical theory about the "perfect market" (Keita 1992) and limiting the government's role to facilitate security among the economic players (Anonymous 2009). The main emphasis of the theory is placed on the issue of the optimal allocation of the scarce resources, including land, labour and capital, to produce a given output. To produce the output, individuals have the possibility to select a composition of input resources among different alternatives. The specific composition of input resources clarifies the production function that can be studied from various angles, such as input-output relationships and product-product relationships. From the input-output relationships, the optimal allocation of resource allocation is on the production function where "the value of marginal product of an input" is equal to the "input price." From the neoclassical

theory's point of view, the assumption of equality between the "value of marginal product of an input" and "input price" is the main source of allocating scarce resources and modification of the equilibrium outcomes in response to changes in levels and kinds of input resources.

Having individually rational economic decision-making as a core of the theory, the neoclassical theory has no room or only little room to explain production from common pool resources. From the neoclassical point of view, accessibility of a group to a scarce resource finally leads to overuse. This theory postulates that every individual only considers his own benefits and exploits as much of the common-pool resource as he can without considering the external cost of damaging that resource. If individuals do not face any regulatory ramifications, then the management of the common-pool resource is overexploited, thus called, as Hardin describes, the "tragedy of the commons" (Ostrom 1990). To solve the problem of overexploitation, the neoclassical theory suggests six solutions. Those include: input quotas, input rights, output quotas, output rights, taxation, and private property (Stevenson 1991).

In a system of quotas on inputs, individuals are limited for the total inputs they apply to extract the common resources. The total input is restricted based on the maximizing the sustainable net revenue. The sustainable level is estimated by non-market and a non-price mechanism, and depends basically on some ecological purposes. In the simplest way, the individual quotas are calculated based on  $E^*/N$  where  $E^*$  is the sustainable level of net revenue and  $N$  is the number of individuals. The system of input rights or licensing of inputs is another solution to limit the resource extraction.

This system is different from the input quotas in the way that input rights are tradable in a competitive market. The resource rights allow the owner to use a certain amount of the inputs. As the rights are tradable under a competitive market, an individual is free to select the number of rights he intends to buy. The price of input rights and the market mechanism operate to limit resource extraction and to prevent resource overexploitation.

The output system, alternatively, put a direct limitation on the amount of harvested output an individual can extract. The quotas and right system for the output is the same as the input system in which quotas refers to non-transferable tickets, while rights are attributed to the transferable one.

The last suggestion of the neoclassical theory to the problem of open access is privatization. By privatization, the social cost (externalities) of the common use is internalized to a single person who maximizes the resource's value. The neoclassical solutions are basically defined under a centralized control when the government impose the regulations.

Although neoclassical suggestions, in particularly private property rights, have been indicated as the best solution to the problem of overexploitation (Demsetz 1967; Stevenson 1991), they are not necessarily the best solutions under some situations (Block 1977; Ostrom 1990). Regarding to the quotas or right regulations on the input or output, the regulations are applicable - even for a long time - when the benefits of claiming rights exceed the enforcement and monitoring costs. For instance, enforcement and monitoring configurations, including the cost of employing police or watchman, collection of fines, trails at courts should never excess the social cost of not complying the rule. In addition, the value of benefits and costs from an implemented regulation may change over time due to changes in technology, the level of resource scarcity and preferences. Therefore, a given regulation that shall be implemented in a certain period of time may not be useful at another period of time.

The other solution - privatization of common pool resources - is also difficult to be implemented under some situations. One difficult situation is when the resource is too big in its physical size to divide among the user group. For instance, the size of almost all rangelands is so big that the cost of operating a ranch (borehole drilling, perimeter fencing, paddocking and water reticulation) is very high. Another situation is when the small resources are nested (interconnected) into broad cooperative entities. The most famous example of the nested resources is irrigation. Different parts of a river, even a small one, are connected to each other that make privatization difficult because activities of one user influence the outcomes of other users.

Another difficult situation to privatize the common-pool resources is when the nature of the resource production is highly risky and uncertain. This situation can be mainly seen in rangelands, having a high variation in rainfall, productivity, topography and availability of water resources. In this situation, privatization causes individuals to bare high production risks, while holding common property rights. The result is that the cost is spread among more individuals, and is used as a technique to manage the high risk of resource production. In many of these

situations, livestock holders found mobility as an effective strategy to obtain livestock needs in an environment with very high variation in quality and quantity of resources. Since mobility requires a large area of rangeland, privatization is nearly impossible to be established. On the contrary to the neoclassical prediction, mobility exists in rangelands of some countries such as Africa and Asia (Gilles & Tamtgaard 1982) for a long period of time. Pastoralist responses to temporal and spatial variation in rangeland resources presented both chaotic outcomes as predicted by the neoclassical theory, and showed that regulated and rational systems will adapt to the varieties of the environment.

Wilson and Thompson (1993) analysed this problem in detail. They show that in the situation of high ecological uncertainty, there is a conflicting relationship between behavioural and ecological uncertainty. Regulation decreases behavioural uncertainty, however, increases the ecological uncertainty because of the limitations on mobility. – one efficient strategy for uncertain environments - and generally freedom of making decision. In addition to mobility, unclear property rights and having some key rangelands are some other strategies to spread the cost of uncertainty among a group of users. These strategies are infeasible under a private system.

Considering the mentioned background, the neoclassical theory is deficient in addressing some issues related to management of common-pool resources. The evidences of failed privatization programs in Iran, including sedentarization of pastoralists (Koochi-Kamali 2003; Ward 2009) and the law of land reform (Majd 1987; Haji Rahimi&Ghaderzadeh 2008) and in other countries such as Africa (Atwood 1990), Mexico (Thompson. 1993), China (Zhaoli, Ning et al. 2005) and Botswana (Zhaoli, Ning et al. 2005; Motlopi 2006) are empirically proven to exhibit the discussed issues related to privatization of common-pool resources.

### **3 New Institutional Economics (NIE)**

#### **3.1 Basics of NIE**

The NIE has been developed to modify misunderstood questions from the neoclassical theory by incorporating institutions in the economic theory. The NIE does not reject the basic assumptions of the neoclassical theory, and accepts the main two assumptions of the scarcity and competition. The more realistic view of the NIE, compared to the neoclassical theory, is that the economic decisions on

using inputs and producing outcomes are not only based on maximizing benefits of rational individuals, but to a large extent based on social and political institutions, governing the economic environment. Therefore, the major movement from the neoclassical theory to the NIE is consideration to the “place of institutions” in the economic theory, especially in the issues associated with managing common-pool resources. By introducing the concept of institutions in analysing the human behaviour from the economics’ point of view, the NIE is able to describe the divergence between the neoclassical expectations from the perfectly rational decisions and the irrational decisions of the economic players in practice.

Nevertheless, the scholars have differently described the linkage between NIE and neoclassical theory. Some scholars describe the NIE as an added approach to the neo-classical theory, in order to increase the capability. Others explain the neoclassical theory as an outdated approach due to the wrong outcomes for some real-world events.

### ***The NIE in the management of natural resources***

Natural resources are defined as the valuable goods that are mainly produced by the natural process for which their supply is severely constrained. Outcomes of human management on consuming the natural resources are often laid between the two extreme spectrums of “exhaustibility” and “renewability.” A resource can be exhausted if the pattern of human management causes the complete depletion of the resource in a finite time. The resource, on the other hand, can be renewable if the pattern of human management was in such a way that the basic stock will not diminish over time (Baland&Platteau 1996). Issues related to management of natural resources, often referred to as common pool resources, are crucial. Additionally, the main two characteristics of “non-exclusion” and “non-subtractability” raise the sensitivity of managing common resources from the other types of economic goods. “Non-exclusion” applies the situation in which it is uneasy or too costly to exclude the potential users from exploiting the resources. “Non-subtractability” refers to the use of a common resource by a single person that reduces the availability of the resource to others. These two characteristics cause consideration to other elements such as externalities and transaction costs as conducive to efficient management of such resources. As discussed in the previous section, the neoclassical theory on the basis of

maximizing the net benefits has no or little room in suggesting an efficient solution.

The NIE, on the contrary tries to find the efficient management by introducing the role of institutions as tools to exclude non-members of a certain group and to protect the natural resources from overuse. This optimal outcomes suggested by NIE may not be rational from the perspective of the neoclassical theory on the basis of individual decision making. According to the NIE, institutional operations are the most important factor in managing the common pool resources, especially when related to the process of decision-making.

### ***The concept of institutions***

Within the framework of the NIE, scholars define an institution in different ways. Ruttan and Hymai (Zhang 1998) consider an institution as the establishment of rules and regulations in a society that has emerged at the aim of facilitating people's coordination by helping them to shape their expectations in a response to other's behaviour. Pejovich (1995) define an institution as the legal, administrative and customary arrangements, making the repeated human behaviour predictable. Bromely (1989) describe an institution as the basic elements that influence individual behaviours in shaping their collective actions. He expands his idea by introducing the three elements of "socially constructed norms," "working rules" and "entitlement" as the means that connect and form the individual behaviours and interactions (Bromley 2006).

Although the described definitions share basic elements of the "institution," the North's definition covers all aspects of the definitions mentioned above.

*"...the rules of the game in a society, or more formally, are the humanly devised constraints that shape the human interaction..."* (North 1990).

According to the North, institutions clarify the way that either individual or common activities are operated within a society. The main role of institutions related to human behaviour is to shape incentives to promote cooperation and exchange. Institutions help people to predict other expectations as well as, help the individuals to shape their expectations in the complex and uncertain environment.

By clarification of the concept of the institutions in the school of the NIE, it becomes clear that, unlike the Neo-classical theory, which is the search for the

question of optimal allocation and the degree of utilization, NIE concentrates basically on the creation, operation, dynamic and variation in the institutions. It focuses on the issues of shaping the various arrangements and regulations created under similar circumstances, and responding to changes in the former rules. Unlike to the Neo-classical theory, NIE creates a process of economic, social and political changes by understanding human intentions, beliefs and regulations to reach a desired end.

### ***Formal and informal institutions***

According to the described background, institutions are limitations and restrictions that have been established to make the individuals interactions easier and predictable. Given such a broad concept that makes the analysis of institutions difficult, scholars classified institutions in different ways (Bromley 1989; North 1990; Ostrom 1990; Ostrom 2005). Although there are many ways for classifying an institution, in this study we will use the North's classification, where the formal and informal institutions can be distinguished and operate separately.

North defined the institutions as “rules of the game” and classified them into two main groups of formal and informal rules. Formal rules are referred to the written rules, arising from governments or other political decisions. As a result of external decisions, enforcing those rules requires some external organizations to be involved. Therefore, the formal rules can be easily changed. The informal rules are those that are internally established and enforced by the community members. A rule is internalized through a process by which the institution remains in the society for a long time, even in the absence of physical rewards or punishments.

Ostrom (2005) proposes a very similar classification, where institutions are divided into two groups, known as “rule-in-form” and “rule-in-use.” The “rule-in-use” is where community members make joint decisions. If one participant intends to understand the initial source of a behaviour in a given community, analysis of the “rule-in-use” is employed. The “rule-in-form,” are those rules that are legally established by the external organizations. In regards to the relationship between the two types of rules, they can be interconnected with each other. There are some other cases that the “rules-in-form” remain written and do not have any influence on the communities' behaviour. The two types of rules are consistent to each other, when the legal rules have taken their orientation from the perceptions of the community members. In this case, the formal rules are often passed by consideration to the regional and local perceptions. If the “rule-in-form” is



established based on external enforcements without consideration to the society's perceptions, the two types of the rules are more likely to be contrary.

In the issues associated with managing the common resources and natural resource degradation, "rule-in-use" play the most important role. The human impact on natural resources will be analysed by evaluating the institutions the people use to manage and extract their common resources. To put it another way, for an analyst who is searching the degradation of common-pool resources caused by human beings, the "rule-in-use" is the most important factor. As the main purpose of this study, to analyse the rangeland holders' behaviours, we will mainly focus on the "rule-in-use." The following section will provide a brief overview of the formal institutions enforced by the government.

### **3.2 The concept of formal institutions**

#### ***Three arenas: "political system," "economic structure" and "protection system"***

According to Pejovich (2008), formal rules can be defined within the three arenas of the "political system," the "economic structure" and the "protection system." These three arenas describe the three stages of preparing an official decision. The "political system" defines the scope for acting in the other two arenas by determination of the relevant organizations and the hierarchical structure, from making decision power during the preparation to execution of the decision-making process. The "economic system" defines the property rights for allocating the scarce resources among those who have entitlement. The "protection system" defines how the prepared rules will be applied, monitored and sanctioned in case of being broken by the participants.

#### ***Political system***

The "political system" includes rules and regulations that define who are eligible to make decisions and to participate in designing rules for other systems including the "economic system" and the "protection system."

#### ***Economic system***

The "economic system" includes the rules that define property rights and the rules that determine the way of exploiting forage resources. We here classify the economic rules into the "property rules" and the "production rules," depending on

the major constraint they assign. By the “property rules”, we mean the rules associated with distribution of property rights among the user group, while by the “production rules,” we mainly consider the rules that determine the grazing techniques and how to exploit the rangeland resources.

- **Property rules:** “Property rules” address who is eligible to control forage resources – f. e. in the case study area Semnan Province (see chapter C)., the formal property rules indicate the boundaries of rangeland parcels and the people who are eligible to use the forage resources of this particular area. In our study area, the formal form of property rules is the constitutional rule on determining the boundaries of rangeland and the members who are eligible to use the forage resources within the specified boundaries.
- **Production rules:** The “production rules” deal with the grazing systems that determine how many livestock should be taken where and when.

### ***Protection system***

According to the definition, the “protection system” reflexes the monitoring and the sanction arrangements.

### ***Illustration: The formal system of Iranian rangeland in the Semnan Province***

The study of rangelands - like other Iranian rangelands - are formally governed by one of the two systems, either the Rangeland Management Plan (RMP) or the Grazing License (GL). Although the two systems are similar in the basic principals associated with the production rules, some differences still exist. The RMP provide the rangeland holders with 30 years contract, while the GL give the rangeland holders annually rights to use rangeland resources. Additionally, another important difference between the two systems is the technical approaches used to estimate the sustainable figures. As the RMP applies more accurate techniques to estimate the number of livestock, it provides the rangeland holders with more technical guidelines about using forage and grazing techniques.

### 3.3 The concept of informal institutions

#### *Three volumes of informal institutions*

Under the definition of informal institutions, which are here defined as unwritten rules that have been practically implemented by the users' group, "norms," "strategy" and "rule" are the three distinguishable terms. While all three terms describe some constraints, limitations and expectations from the peoples behaviour, they differ in their ways on prescribing, advising and permitting the duties or outcomes expected from the targeted society (Ostrom 2005).

The three volumes of "strategy", "norms" and "rule" are attributed to the roots from which the informal institutions are oriented. In addition to the nature of the institution, the three volumes indicate how severe a given institution is. It is worth mentioning that a given volume is not stable and can be transformed to a more adoptable one over the time. For instance, in a regular case, a strategy can be transformed to a norm and finally the rule.

The most common approach to distinguish the three volumes was proposed by Ostrom (2005) and Ostrom and Schwab (2008/06) . She, with her colleagues' collaboration (Crawford & Ostrom 1995), developed a syntax grammar to distinguish the three volumes of informal institutions. The following are a brief description of the five alphabets (ADACE) from this grammar.

- Attributes (A): this refers to either people or organizations that has been targeted by the considered institution.
- Deontic (D): is referred to the imperative status of the given institution. The Deontic element shows how strong the institution is defined. The key words for Deontic are forbidden, permitted, obligated. The Deontic is not only limited to the key words, other words with similar interpretation such as "may," "must" and "should" can be used, as well. Additionally, the Deontic is an element that, for some cases, can represent the strictness of the institution. For instance, "must" is stronger than "should" (Ostrom). Nevertheless, for this study, we consider all Dionic with similar severity.
- Aims (A): referring to purpose and outcome of implementing the institution. It represents the type of tasks and duties the "Attributes" are expected to do. Description of the process and purposes of the institution such as what type of activity should be conducted or how the activity should be applied are attributed to the Aim.

- Conditions (C): is referred to the conditions and circumstances under which the “Attributes” should, may, and must do their duties. They are in fact the prerequisites on the “Aim”. Conditions in an institution can be specified by “when,” “where” (Crawford S & Ostrom 1995), and “if”, “unless” (Basurto X and Kingsley 2009).
- Or else (E): is referred to the punishments and sanctioning that will occur if the attributes do not meet the aims under defined conditions. Sanctions vary in terms of if they are observable. The observable sanctions are those that are physically tangible. The “or else” defined by Ostrom indicates only the physical sanctions and punishments.

The second types are those sanctions that are not physically observable. People do some activities because of not having guilt and shame. To realize the existence of “Or Else” precisely, Ostrom (2005) indicated three additional conditions. First, the “or else” statement should be admitted by a group of people from either the government or a society. Second, another set of rules based on other Denotics and Aims should be assigned for situations under which the individuals are not able to follow the Aims. Third, in order for the “or and else” to be endured, a monitoring system with associated responsibilities and rights should be determined.

The invisible sanctions that are not included by the “or and else” statement are the result of moral or social pressures. The moral pressures are associated with the personal feeling. The “Attitude” does obey the rule because of avoiding the “bad feeling” of being guilty about himself. Social pressures are related to the society around the “Attitudes.” In this situation, the “Attitude” obeys the rules because of avoiding the “bad feeling” of being guilty about their surrounded society (Ela 2008; Schlüter & Theesfeld 2008).

Although some authors proposed some challenges to the syntax grammar (Schlüter & Theesfeld 2008; Basurto & Kingsley 2009), especially for empirical situations, the grammar still remains as an outstanding basis for recognizing the three types of institutional volumes.

### ***Shared strategies***

According to the syntax grammar, the “shared strategy” contains the three components of “Attitude,” “Aim” and “Condition” (AAC). The important thing is

that the strategy lacks the Deontic component, referring to the imperative status, and the punishment system. Therefore, a strategy can be changed without any announcement or having expectation to be either internal or external punishment (Schlüter & Theesfeld 2008).

Theoretically the “shared strategy” is defined as “prescription” by Ostrom, and “constraint” by North (cited in Schlüter & Theesfeld 2008). The term “strategy” is used in the two contexts of “theoretical game” and “empirical study.” In the “theoretical games” content, the strategy is the option that was selected by a group of players among various alternatives. In this situation, the strategy is often built based on players’ expectations from each other about the coming behaviours. In the “empirical study” content, strategies are the institutions created by individuals or a group of people to change their situation in an attempt to improve the outcomes they can achieve. In other words, strategies in the real world are feasible solutions adopted by the members’ to get ride of the existing difficulties. The two following parameters can cause the “shared strategy” (Ostrom & Gardner 1994):

- 1) Evolutionary or learning process through which the users’ group come up with a set of strategies. The obtained strategy often increases the joint benefits, while it may decrease the individual benefits.
- 2) The second is related to the cooperation and self-conscious efforts of the group to reduce their joint payoffs.

### ***Norms***

Theoretically, norms describe what activities are right and what activities are wrong based on people’s expectations about their own behaviour and other people’s behaviour (Baland & Platteau 1996). Norms provide institutions with a particular type of behaviour for people to follow.

According to the syntax grammar, a norm contains the three pervious elements plus the Deontic (AACD). Therefore, according to the syntax grammar, the difference between a norm and shared strategy is in the Deontic that specifies the imperative status under which the Aims should be performed. Although both types of the institutions do not contain the component of “or and else,” the norms are restricted by invisible sanctions and punishments created by personal “bad feeling” of free riding. In fact, unwillingness to have a “bad feeling” is the main monitoring system, protecting the people from breaking the norms. Creation of the “bad feeling” can be results of the two sources “morality,” “esteem,” “sociality” and “disapproval.”

By these different sources of “bad feelings,” the norms can be separated into two general groups of personal norms and social norms.

- ***Personal norms (personal morals)*** are related to the behaviours that one does because of his emotional feelings like guilt (Ela 2009) or pride. The feelings of guilt or prides are the invisible benefits or costs raised when a person behaves in ways that he thinks morally right or wrong. Following this type of institution does not require other people to know how the person acts, or any external sanction to be imposed. The mechanism of self-control or potential guilt is used as means to control people’s behaviour (McAdams and Rasmusen 2007).
- ***Social norms (social influences)*** refers social pressures associated with not individuals, but the society (Ela 2009). The social norms are based on beliefs on other’s opinion rather than the opinion of individual. Behaving based on social norms can be resulted from the two feelings of esteem and shame. Esteem is when people care about what other people think about their behaviour. One may act in a particular way because he wants to be approved by others. Shame is when one cares about his behaviour to be accorded with the normative/standard beliefs of others. One may behave in a particular way because he wants to successfully live up with standards based on normative beliefs of others, regardless whether he himself has the same normative beliefs or not (McAdams & Rasmusen 2007).

Nevertheless, social norms and personal norms are deeply connected to each other and influence each other through the process of internalization. Internalization refers to the process through which the institutions have been entered and maintained for a long time. In many cases, when the people hold very strong personal norms, they attempt to transfer them to the surrounding people. For some people, social norms may be internalized into their personal norms. Based on human psychology, people internally consider the prevailing behaviours to be correct. They would usually prefer to behave as other people behave, and even to believe as other people believe (Ela 2009). In fact, social norms influence people’s behaviour by shaping their preferences and their individual choices.

### ***Rules***

Some scholars have interchangeably used the term “rule” and “institution,” Nevertheless, there is a certain border between rules and institution. Rules are basically established because of benefit and costs, obtaining from the obedience or

free-riding (Schlüter & Theesfeld 2008), while institutions are restrictions, prescriptions and limitations that human uses to organize any form of their relationships and interactions (Ostrom 2005).

All the five components of the syntax grammar are contained by the rule. The prominent difference between the rules and the other two types of institutions is the existence of punishment and sanctions that are very clear and tangible (Ostrom & Schwab 2008/06). Rules can arise from norms. Transforming norms to rules cause the norms to be stabilized in the society. While the established norms can be interrupted by self-centred people, developments of gradual and reliable sanctions lead the institutions to become more stable (Ostrom 2005). Additionally, norms can be enforced by the government enforcement that, in this case, the establishment does not require a long period of time.

### **3.4 Strategy, norm or rule?**

The syntax grammar made some theoretical boundaries among the three volumes of institutions based on the existence and forms of punishment and sanction system. Nevertheless, in the real world of the informal institutions, the definition of these three boundaries has been challenged by some authors (Licht 2008; Schlüter & Theesfeld 2008; Basurto, Xavier, et al. 2009).

Although some authors argued the difference between the rules and norms (Schlüter A & Theesfeld 2008; Basurto Xavier, et al. 2009), it does not seem to be a big challenge if we follow the syntax regulations. Distinguishing external sanctions and punishments is not significant, even though it can be observed in different forms. The important factor to decide about rule is the punishment system to be obvious for every engaged person. If you ask different people about sanctions in case of not obeying the rules, their answers would be clear and similar, even though their personal reasons to follow the regulations vary.

The main challenge occurs when a researcher wants to decide between the strategy and norm. By the syntax regulation, the strategy should lack the component of Deontic, while in many cases this linguistic word sounds to be hidden in the actual activities. For instance, the approaches selected by a group in a team game are known as strategy because the people could change their method without receiving any form of internal and external sanctions. For each member of the team the performance of his duty may be a task, which refers to the existence of Denotic in the performing members' Aims. In fact, by selecting any decision

(either strategy or norm, or even rule) one assigned some Dentoics to himself to do his duty, even though he feels completely free to select other approaches or methods.

The second possibility to distinguish strategies from norms is the existence of internal sanction in the “norm” statement. Theoretically, norms are restricted by some internal sanctions on the basis of feeling guilt, shame or esteem. Strategies are, on the other hand, either individual or cooperative decisions without feeling bad in case of not obeying the regulations. The process of decision-making includes cooperation of various types of emotions. For instance, a person may follow the group decision because of obtaining the cooperative benefits, and not being afraid by any form of sanctions. Preferring cooperative benefits than individual benefits is likely to be influenced by some inner factors such as what he has been learnt by his families and close friends over the time. Although this inner impact is different from the feelings of shame, guilt and esteem, distinguishing them from emotional feelings, especially for small group of people, is sometimes a challenge.

The third possibility to distinguish strategies from norm is consideration to the historical environment and the past events in which norms are born out and evolved. Norms can be initially arising from different sources including strategy, values, attitudes and culture. Whatever the initial sources for raising a norm is, it should be supported by strong esteem in the society as well as strong pattern of approval and disapproval for following the initially established institution. Creation strong esteem and patterns of approval or disapproval of following a given behaviour in a society require people to obtain a consensus understanding about the behaviour. The common behaviour would be difficult to be shaped under a certain circumstance. One is when the government or any other external organization do not prevent the common behaviour from being privileged (McAdams & Rasmusen 2007). Social events that happen over a time should support an argument or belief to become stable in society or groups. The external organizations, such as the government, can facilitate or obstruct the process of norm emergence by publicizing or forbidding the existing consensus (McAdams & Rasmusen 2007). Therefore, looking back to the historical events of the study society can provide us with some insights into whether the society has had potential capacities to create a set of norms or not.



## **4 Theories about Rangeland Management**

### **4.1 The Diffusion-Adaption-Theory by Rogers**

Diffusion theory investigates the process by which an innovation such as a new idea, practice or product spreads through a community (Rogers 2003). Introduction of an innovation to a community eventually leads to rejection, implementation or adaptation of the innovation by the community members. Rogers (2003) divided the dynamic process of community decision-making into five stages including knowledge, persuasion, decision, implementation and confirmation. The first stage is awareness of the existence of the problem and the innovation. The second stage happens when potential adopters intend to try the innovation. Depending on trial results, potential adopters make a decision to implement or reject the innovation. Use of the innovation may be scaled up if the trial results convince the potential adopters. After implementation of the innovation, adopters evaluate continually their decisions. Therefore, adoption process is never completed since the adopters consistently evaluate and modify their assessment under new circumstances (Pannell et al 2006).

According to Rogers (2003), the process of adoption or rejection of an innovation is affected by the characteristics of potential adopters and perceived attitudes of innovations. Individual characteristics, such as age (Burton et al 1999), education, training experiences, level of adopter's income and type of ownership (Gauthier, 2000) have been addressed as the factors influencing perception and willingness of landholders to accept new practices (Bryson et al 2007). Additionally, attitudes of the innovation such as relative advantage, complexity, compatibility, trialability and observability of the new practice affect the learning process, in particular the willingness of adopters to spend time, energy and finance to try the innovation. Relative advantage is defined as the degree/amount of benefits perceived by the new practice. Complexity is defined as the degree of ease or difficulty of the innovation to be understood and used by the adopters. Compatibility is referred to the extent to which the innovation is accord with existing knowledge and social values. Trialability is defined as the degree to which the innovation is applicable on small scale prior to implementation for the whole community. Observability is the degree to which the potential users observe the advantages of the innovation. These characteristics of innovation affect not only the potential adopters' decisions to implement the new practice, but also the rate at which the innovation would be adopted by the community (Geiser & Greiner 2001).

## 4.2 Property Right Theories

### *Again: Clustering informal strategies*

Strategies that can be attributed to the institutions have been classified in different ways. Formal and informal rules are the most famous classification as suggested by North (North 1990). As we discuss in the pervious chapter, the formal institutions are those that are designed by authorities, while the informal institutions are those that are crafted by the society. Any type of these two classifications can be extended to sub-groups according to more detailed sources. For instance, the formal institutions can be grouped into international and national rules, which they can again be classified in the state, the provincial and the local rules. Borner S. and M. (2004) presented another form of classifying the formal institutions into the political institutions, which determine the authority structure and the process of political decision-making, and the economic institutions, which determine the property and contract rights. As described in the previous chapter, Ostrom (2005) created a relatively similar type of classification, according to the sources where the institutions have been developed, distinguishing between rules in form (De jure) and rules in use (Defacto). The Dejure rules are practically enforced based on the legislative law imposed by the authorities, while the Defacto rules are those that are imposed by the involved people.

Ostrom (2005) suggested two other broad types of institutional classification, using dimensional approaches. The first one was the ***vertical approach*** that analyses the existing institutions based on the authority involved in the process of decision-making. This classification presents regulations into the 3 groups of “Operational rules,” “Collective choice” and the “Constitutional level.” The “Operational rules” are those rules that influence the daily decisions. The “collective choice” rules is referred to “operational rules” by defining who is eligible to do the operational rules and who is eligible to change these rules. The “constitutional rules” are the highest layer of rules.

The ***horizontal approach*** focuses on the aim of the given institutions. The horizontal classification can be conducted for each defined layer of the vertical classification. The horizontal approach of classification can be conducted in many different ways. For instance, the syntax grammar that is used for distinguishing among strategies, norms and rules can be applied as foundations for institutional classification.

Additionally, classification based on any syntax element can be conducted in many different ways, leading to many different forms. For instance, one can use the concept of the DEONTIC (must, may and may not) as the basis for the classification system. Alternatively, in another form of classification, one may lay all forbidding rules into one group, while permitting rule into another group.

Nevertheless, Ostrom (2005), through the horizontal approach, conducted a classification based on the third element “Aim” of the syntax grammar. Having mentioned that there is no unique system, describing all possible aims of designing any kind of institution, Ostrom described this classification as a very general one based on the “Aim” of institution as a foundation of the classification.

According to this classification, the institutions can be grouped into the six broad classes of: Position, Boundary, Choice, Aggregation, Information, Payoff and scope.

- ***Position institutions*** refer to the rules that specify different types of positions available in the action arena as well as limitations on the number of holders for the defined positions.
- ***Boundary institutions*** refer to the rules that specify who is eligible to enter a position and the conditions under which the individuals may leave (must leave) the position.
- ***Choice institutions*** refer to the rules associated with the tasks and duties that position holders may fulfil (must fulfil) under certain conditions.
- ***Aggregation institutions*** refer to the rules associated with determining whether individual decisions or group decisions are required through the decision process of taking an action.
- ***Information institutions*** are rules associated with provision of information available to the position holders.
- ***Payoff institutions*** are rules associated with determination of external rewards or sanctions because of doing (or not doing) particular actions.
- ***Scope institutions*** are rules associated with constraining the range of outcomes and not actions.

Although the described classification is a result of using the “Aim” of building the given institutions, the categorized groups are not necessarily similar for all case studies. While a researcher in his particular study may find some groups similar to the defined groups, he may find some other institutions based on other purposes that have not been considered by the described classification. Therefore, in many

situations, classifying institutions upon their aims should be conducted through deductive approaches, while considering the pre-described model.

Additionally, while there are thousands of forms for classifying the institutions, there is no universal classification that is useful for all types of research (Ostrom 2005). To put it another way, for any piece of research, decision on, which type of classification should be used, depends on the research objectives. For instance, the vertical approach may be used for understanding the relationship between different authorities, while the horizontal approach may be more useful for analysing interactions in the action environment within which the institutions have been crafted.

For the purpose of our case study (see chapter C) – that is to identify the relationship between the theoretically driving factors and property strategies, on the one hand, and the impact of the implemented “strategies in use” on the outcomes related to how to exploit forage resources, on the other hand – the classification should be based on the “Aim” of implementing the strategies. In fact, the purposes for which the strategies have been implemented should be laid at the core of consideration. Therefore, it is required to sort the “strategies in use” at the practical unit (users’ group) on the way that the set of strategies in a given category identify a similar purpose.

### ***The bridge between institutions and property regimes***

As we described in Chapter B 2, a big challenge to the neoclassical theory is ignoring the role of institutions on the economic behaviour and decision-making. The role of the institutions became apparently clear in the argument to the “tragedy of the commons” where a jointly use of shared limited resources was mentioned as an irrational behaviour, leading theoretically to resource depletion. Developing the argument to the “tragedy of the commons” dilemma was emerged when some scholars (Dahlman 1980; Ostrom 1990; Ostrom 1998) discussed some real cases of shared resources used by a group of people; while there was no sign of resource depletion. The argument to the “tragedy of the commons” dilemma leads finally to distinguish between “open access” in which there is no institution and the “common property” in which a set of institutions are involved.

Institutions, particularly in the informal form, are defined as the broad range of human activities to regulate the social behaviour with a certain purpose. The existence of institutions causes the individual and social behaviours in diverse

situations not to follow the same direction. For instance, in one situation the outcome of social behaviour may show up very similar to a rationally individual decision as neoclassical theory expected, while in another situation the outcome may be very far from the rationally individual decision. This fact is particularly true in the case of managing the common lands where social configurations, known as property institutions, play an important role in determining social behaviour and decisions in a society.

Schlager & Ostrom (1992) indicated five property institutions, known as property rights, which determine the type of property regime in the area. Following are brief definitions of the five mentioned property rights.

- ***Access right/institution***: defines who is allowed to enter a definite bounded area for enjoying its benefits.
- ***Withdrawal right/institution***: defines who is allowed to extract product units of the defined physical area.
- ***Management right/institution***: defines who is allowed to regulate the practical exploitation patterns or to transform the existing patterns for making improvements.
- ***Exclusion right/institution***: defines who has access rights and how his rights can be transferred.
- ***Alienation right/institution***: defines how the holders of the four previous rights can sell or lease their rights.

### ***Property right regimes***

With consideration to the fact that this bundle of rights can be attributed to individuals or groups as well as possibility of various concepts for each type of rights, a number of forms of property regimes can be developed.

In the most famous way, property regimes are grouped into the four types of “state property regime”, “private property regime,” “common property regime” and “open access.”

- The “***state property regime***” is defined as a situation in which all property institutions in all aspects from establishment to execution rest in the hands of the state.
- The “***private property regime***” is defined as the opposite way of “state property,” a situation in which all property institutions in all aspects are in

the hands of only one person. A detailed description to the two forms of “private property” and “state property” will not be presented and discussed afterwards, as all study cases (like many of the Iranian rangelands) were formally governed by a kind of common property regime.

- The “***common property regime***” reflects a situation that a defined number of people own and manage a limited boundary of common pool resources. To describe it in more detail, the following characteristics should exist in a common property regime:
  - The common pool resource should be clarified by well-defined physical and ecological boundaries.
  - There should be a clearly defined number of people who are entitled to use the common resources. People out of this group are excluded from resource use.
  - The common pool resource is used by a group of people, more than one person.
  - There are a number of rules associated with resource extraction. According to these rules, the users have certain rights and duties among themselves in relation to using, managing and protecting the common resources. These rules should be well understood by the entitled people.
  - There is a potential competition among the entitled users, since using one unit of resource imposes negative externalities to other users.
  - Some rules associated with resource extraction have been established. These rules clarify the rights and duties of the entitled users to each other.
  - The entitled users who hold some types of property right may or may not agree with the group of actual users.
- Under “***open access***,” none of these rules exist. There is no rule to exclude some people from extracting the resources.

While there is a certain cut between “common property regime” and “open access”, many forms of property regimes can be imagined somewhere between these two property regimes. Considering the fact that the distinction between the two property regimes is because of the rights and duties that people have for each other, depending on how strict are theses duties and rights and the way that they were distributed among the people, many property regimes are either between the

private property regime and common property regime, or the common property regime and the open access.

This fact has been indicated by some studies:

Baland & Platteau. (1994) describe “unmanaged common property”<sup>29</sup> as a regime of resource use in which a set of property rights have been established for a certain number of people. Nevertheless the property rights among these users remain not wholly defined. In this situation, the resource extraction is not regulated, while the well-defined number of people entitled to use the common resources.

Wilson & Thompson (1993) attempts to describe the trade offs of ecological uncertainty, the behavioural uncertainty and the property institutions, a continuum system of property regimes where private property regime and open access are at extremes. They conclude that in an uncertain environment with a fix condition of resource endowment, the more the users’ group consider the ecological uncertainty the more they move toward the open access. While the more the users’ group consider the behavioural uncertainty the more they move toward the privatization.

Quiggin (1995) attempts to describe the common property rights in the semi-nomadic situations regarding the economics of scale in terms of livestock production, that property regimes in a real situation are a combination of “pure common property regimes” and “pure private property regimes.” He presented that the pure property regimes - either private or common – in terms of ownership is very rare to be observed in the real cases associated with rangeland management.

In the practical property regimes all listed property rights may not be included in the sense that some of them may be inconceivable and impractical. Nevertheless, in any form of common property regime, the two main bundles of rights associated with “the right to use” including the right to use the common resources, the right to change the use, and all rights associated with destroying resources, and “the right of alienation” including the right to transfer the accepted rights through bequeathing rights or selling rights are required to determine the type of property regime.

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<sup>29</sup> Stevenson (1991) defined this situation as the “limited users open access”.

### ***Analysis of property institutions***

Although the term “analysis of property institutions” includes various topics, the “institutional change” is a critical issue for those, who study common resource degradation, in particular land degradation. Discussions on this topic focus often on the change of property institutions over the time and space that bring the two broad topics into institutional change, known as:

- “Dynamic analysis of changes in property institutions.”
- “Analysis of diversity in property institutions.”

### ***Dynamic analysis of changes in property institutions***

The dynamic analysis of property institutions concentrates on the changes in property institutions over the time. There is a rich literature on evolution of property institutions. We here categorize the main ideas about the property rights evolution into the four following models:

- ***The demand model of property rights change:*** This model has been developed based on the expected costs and benefits obtained from more exclusive and secure rights (Demsetze 1967). Some benefits of more secure and exclusive rights are resource transformation to more efficient use and users and more possibility of increased investment in resources. Changing to more exclusive rights include transaction costs associated with the introduction and enforcement of rights over smaller and more individuals. According to this model, the population growth and market commercialisations are the two important factors in increasing the net benefits obtained from changing the property regime into more exclusive and secure form.
- ***The Bromley model of property rights change:*** The model was developed by Bromley (1991), who distinguishes the four common types of property regimes. He evaluates these property regimes based on the social efficiency that include the economic extraction and transaction costs. According to this model, the private property facilitates the greatest opportunity to extract the economic benefits, while it is with the highest transaction costs. The ordering the property regimes based on the components of the social efficiency, the common property lies in the next category after private property, followed by the state property regime, and finally open access. According to the model, under the mentioned circumstances, the increased scarcity of land resources, due to population



growth or increase market commercialization, causes property regimes gradually moving from open access to the state property to the common property and ultimately private property regime.

- ***The supply of property rights' change*** was initiated upon considering the supply side of changing institutions (Ruttan & Hayami 1984). According to the model, changes in institutions can be induced by factors such as changes in endowments, technology or product demand. In fact, the underlying factors are most probably invented and adopted because of economizing relatively scarce resources. The model indicates that changes may be dramatic or incremental and innovations may promote new forms of property rights or more efficient market mechanisms.
- ***North's model of institutional change:*** This model draws upon the North classification of the institutions into the formal and informal institutions. According to the North model (North 1990), the driving variables that may shift the property regimes can be grouped into the two categories of "endogenous variables" and "exogenous variables," depending upon which type of formal or informal institutions will be influenced.

The endogenous factors are mainly supported by individual or social-mental models that describe why the economic decisions under the same situation are different from each other and from the rational decision expected by the neoclassical theory. With consideration to the incomplete and imperfect nature of the information, North described the diverse outcomes of interpreting the same situation. According to the mental models, the diverse outcomes are in part a result of different norms and values from one society to another society; and in part occur through experiments, differing from one environment to the other. To sum up, individual perceptions about the actual situation and existing circumstances play the main role in making decisions and selecting the relevant institutions.

The exogenous factors reflect the influences initiated from the outside of the actual society. Pejavoush (1995) describe the three approaches of holistic, ideological and incremental to describe the exogenous factors of institutional changes. The holistic approach refers to generalization of the historical events and personalities that are used to re-determine directions of the social and economic development. The ideological approach is associated with reasons to build the ideal society as the "just society" and

structuring the institutions towards the “just society.” The incremental approach tends to exogenously change the society by creating small changes in the existing rules of the game.

### ***Analysis of diversity in property institutions***

The discussions related to the diversity of property institutions begun with the “tragedy of the commons” dilemma. The issues were initiated by the discussion about the economic efficiency of privately managed-systems against commonly managed systems. Analysis of some actual commons in the world support the idea that common-managed system could be the most efficient system of management for resources with specific attributes and under certain circumstances. The commonly managed systems are particularly suggested for regions where the spatial and temporal risks of producing resources are very high. The discussion about the tragedy of the commons dilemma ended up with distinguishing between the common property regimes and open access.

A major topic of the recent studies on the property institutions focus on various types of common property regimes and certain sorts of circumstances under which the forms of common property regimes were crafted and maintained. For the purpose of analysing the diverse institutions in different regions, the variables and elements are assumed to be stable at a certain time. Scarcity of resource production (Ruttan & Hayami 1984; North 1990; Liu S.&Y. 1998), resource attributes (Ostrom 2003: 181), employment opportunities (Liu S. and Y. 1998), the condition of the local market (Ruttan & Hayami 1984; Liu S.&Y. 1998), people’s characteristics (Ostrom 2003: 181) are the factors that have been empirically underlined in establishing property institutions.

While the mentioned studies focus primarily on the influence of a few variables on the structure of property institutions, there are some studies on providing a general framework for studying institutional diversity. Agrawal & Gibson (1999) described that understanding the communities at the three following cores requires analysing the diversity of the institutional structure in terms of natural resource conservation:

- Multiple actors that hold multiple interests.
- The approaches through which people interrelate at the local level, between the local level, and outside organizations such as governments.
- The formal and informal institutions that facilitate people’s interactions with each other.

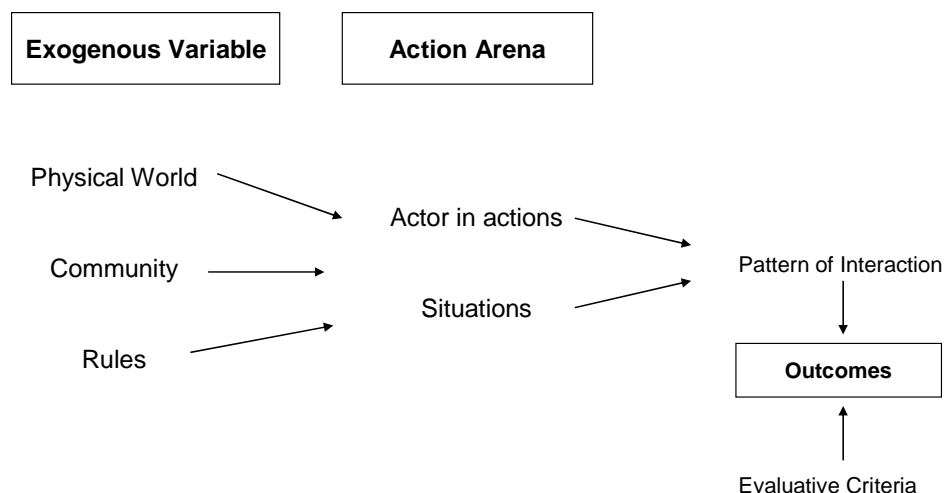
The framework of Institutional Analysis and Development (IAD), developed by Ostrom (2005), is one of the most famous frameworks for analysing institutional environments. The IAD framework defines the two important cores of “action arena” and “exogenous variables” for analysing the institutional diversity. The “action arena” is defined as the interaction between the “participants” and the “arena situation.” The “arena situation” includes all variables associated with the social environment where participants conduct their activities. The “action arena” is assumed to be influenced by some exogenous variables that contains the three types of variables such as:

- The “rules” used by participants to run their relationships.
- The attributes of the ecological/biophysical environment.
- The structure of the community within which the “action arena” occurs.

The outcome of the interaction among IAD elements are shortly described by the three elements of

- The aggregate net benefits obtained from the resources
- The distribution of the obtained benefits among the members
- The transaction cost associated with each outcome.

The IAD framework was developed through a further stage of institutional analysis by understanding the linkage among the important elements. The IAD framework has been summarised in the following graph.



**Figure 5: The IAD Framework from OSTROM (Source Ostrom E. and J 1994)**

### ***Specific characteristics of rangeland institutions***

The previous discussion brought us to the issues related to how the social institutions, in particular property institutions, associate with the management of common resources are influenced by different factors. Besides the general factors that are common for most types of common resources, some specific factors are unique for the particular type of natural resources. These unique factors are mainly associated with resource characteristics.

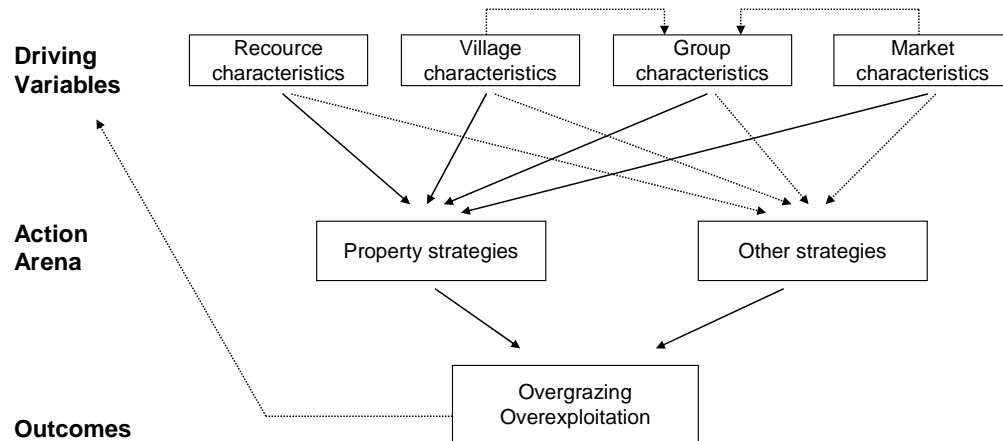
In regard to rangeland, the resource distribution over time and space is assumed to influence the structure of property institutions (Wilson & Thompson 1993; Kamara 2000; Vanderlinden 2000). This idea is strongly supported by the “new range ecology” theory (Behnke R. and C. 1993). According to the theory, without consideration to the type of production system, high variation in the amount of rainfall over time causes the forage resource to be temporarily and spatially changed. Due to the existence of the environmental variability, the users are often searching not only for maximizing the final products, but also managing the environmental uncertainty.

Various empirical studies document the risk averse strategies used by livestock producers who seek to manage the uncertainty supply of forage resources through establishment of various managerial and property institutions. The most well-known example is mobility under the common management rangelands (Kamara 2000; McCarthy et al. 2000; Vanderlinden 2000). McCarthy et al. (1998) indicated a system of poorly defined property institutions, known as fuzzy access rights, as an effective system in managing pastoralism. In the suggested model, mobility with mutually adjustable access to common rangelands with flexible boundaries plays an important role in reducing the environmental risk. They concluded that property institutions referred to accessibility to various rangelands is more complicated than what is described by the common property or open access model. Ultimately, for rangeland resources, the way the forage resources are spatially and temporarily distributed and the underlying variables including the geographical location influence the system of property institutions.

### ***Conclusion: Conceptual framework for the Case Study Semnan Rangeland***

Derived from the above theoretical discussion, the conceptual framework draws largely on the IAD framework suggested by Ostrom (2005), norms and cultural factors by North (1990) and induced-driving variables by Ruttan & Hayami

(1984). The framework (see Figure 6) is designed upon the four fundamental characteristic of the environment as “driving variables” that are hypothesized to influence the strategies for interacting between users’ group and common resources known as “action arena”. The implemented strategies are assumed to influence the outcome associated with resource extraction that will be evaluated based on the RMP and GL structures.



**Figure 6: Conceptual Framework for the Case Study Semnan Rangeland**

The fundamental basis of the conceptual framework analyses the impact of the environmental characteristic including “group characteristics,” “village characteristics,” “resource characteristics” and “market characteristics” on the structure of property strategies as the set of institutions, playing an important role in the way the forage resources were extracted. It is expected that group dissimilarities in any type of the listed elements might cause different incentives and preferences in regards to property institutions. The different incentives, on the other hand, might influence the structure of property institutions, and as a result of that, diversity in the structure of property institutions are evaluated.



## **C Case Study of Semnan Rangelands**

# **I Objectives of the Case Study**

The specified objectives of the case study are:

- To analyse the diffusion process and the diffusion speed of the RMP in Semnan Province
- To describe the land parcels in Semnan Province and to identify the perception of the rangeland conditions and the purpose of land use from the perspective of the users
- To analyse the reaction of the nomads on Governmental campaigns
- To identify the type of the informal institutions currently applied in the study area
- To classify the applied informal institutions based on the regime they are using
- To identify factors that influence the applied regime
- To estimate the likelihood of implementation of the RMP from the users' perspective based on the identified factors.

The case study will be presented as described in the following. In the following section C II, the reasons for choosing the counties Semnan and Damghan in Semnan Province as the research area are stated. Important background information on the research area in order to understand the applied institutions are presented in detail e.g. demographic, geographical and climate conditions in this section as well. Against this background, the formal forms of property rights in Semnan Province are presented. A description of pros and cons of the rangeland management plan and reasons for not being implemented successfully in the study area deepen the problem statement. Background information about the economic situation, industry, agricultural production and education are given. A summary of similarities and differences of Semnan and Damghan completes the introduction of the case study area.

The following section C III describes the research methodology in detail. In section C IV to C VII results of the case study are presented and discussed.



## **II Basic Information about the Case Study Area**

### **1 Selection of the research area**

The main criteria for the selection of Semnan Province as the research area are:

- Access and sufficient data information on ecological conditions of the rangelands including ecological quality
- the comparability of the gathered data which other research studies in Iranian rangelands in the field of rangeland ecology
- the famous tradition in livestock husbandry

To get access and sufficient data information on ecological conditions of the rangelands in Iran is not trivial due to the difficulty of the large size of the rangelands. Therefore, accessibility to rich information on the ecological quality of investigated rangelands formed the main criteria for the site selection. For almost all of rangelands in the study area, information on the forage productivity in terms of grazing (carrying capacity)<sup>30</sup> was accessible through either Range Management Plans or Grazing Licenses. In addition, many research studies in Iranian rangelands, on the field of rangeland ecology were conducted in this area. Semnan Province has also a long tradition in livestock husbandry and is therefore famous. The selection criteria were based on the Forest, Range and Watershed Management Organization<sup>31</sup>.

Before the land reform, Semnan and Damghan were one of the major livestock producers managing a great part of rangelands in Iran (Shahosseini 2001). Beside of producing livestock and associations, they implemented their own traditional ways of land management to protect their possessed lands from degradation (Shahosseini 2001). After the law of land reform, the traditional system has been broken and the rangeland condition in this area - like the whole rangeland of Iran - has been weakened. As an effect of that, rangeland improvement became a serious

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<sup>30</sup> Carrying Capacity is a technical term that addresses the potential stocking rate of pastures in a community measured as either the number of hectares needed to support one animal unit or number of animal unites could be supported by one hectare during the course of one year McCarthy, N., A. Janvry, et al. (1998). "Land Allocation under Dual Individual-Collective Use in Mexico." *Journal of Development Economics* **56**: 239-264..

<sup>31</sup> Moasessye tahghighat Jangal, Marta & Ab-khizdari

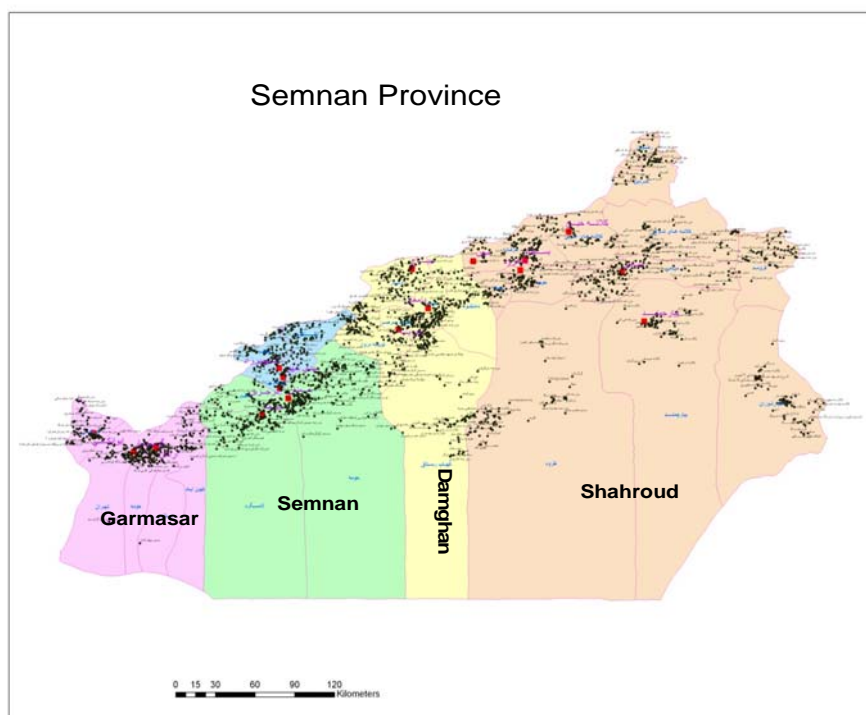
issue in the government's plans. Consequently, governmental research centers have developed the Rangeland Management Plan (RMP) to persuade the land users to sustainable practices. Although 25 years passed since the establishment of the plans, still the population of livestock for summer lands in the Semnan province is 15 percent and for winter lands 11 percent over the carrying capacities defined by the plans (Fars News Agency 2007; Islamic Republic News Agency 2007).

## 2 Semnan Province

### 2.1 Basic Information

#### *Demographic conditions of Semnan province*

Semnan Province occupies about 92388 km<sup>2</sup>, 5.6 percent of the total area of Iran. It is defined as the sixth province of Iran in terms of area, but the lowest in terms of population. The population density is 5.4 person/km<sup>2</sup>, which is very low in comparison to other provinces of Iran. The province includes 4 townships, 16 cities, 12 districts, and 28 rural districts.



**Figure 7: Map of Semnan Province**

The total province population is over 501,500 (official statistics, 1996), 68.2 percent of who are settled in the cities, and 31.7 percent in the rural regions. The population of the pastorals in the area is about 15,000 (nomad organization, 1996).

### ***Climate and geographical condition of Semnan***

The weather is influenced by the dry, warm winds coming from Kavir desert, but there are three distinct regions:

- *Southern region*: the zone includes Garmsar, Semnan, and Damghan with a dry, warm weather.
- *Northern region*: includes Shahmirza, and the North of Shahrood and Damghan. The weather is dry and cold in winter.
- *Northeastern region*: includes Mami and Calapoosh plains and wet and cold area.

Average temperature of the area varies between about 44°C in the warmest months of a year, and -11°C in the coldest months of a year. The mean annual rainfall is about 144 mm that rises from west to east and south to north. Amount of humidity across the area follows the same pattern. Average relative humidity of the area is about 40 percent.

The geographic characteristics connect to the north of the province and the south of the mountainous chain of the Alborz and the south of the province to the Kaveer desert; the province is topographically divided into two major areas including the mountainous area in the north to fertile outskirts, and plain in the south. Therefore, the Semnan province includes both even plains with relatively shallow water resources, and high mountains covered by rich vegetation. Thus, the ecological conditions the area is associated with vast biodiversity.

## **2.2 Land use**

### ***Agriculture***

Nearly 2 percent of the area is allocated to agricultural production. About 49 percent is irrigated agriculture, and 51 percent are dry land agriculture. About 61 percent of the total agricultural land is allocated to annual plants, 14 percent to

permanent plants, and 25 percent are fallowing lands. Crops, cereal, grain, forage, oil seeds, and vegetables are the main permanent plants.

### ***Rangelands***

Semnan Rangelands have been estimated to comprise about 5.5 million hectares, which is about 5.95 percent of Iran and 67.7 percent of Semnan Province. Distribution of the rangelands is strongly influenced by geographical and weather condition, with a particular influence due to the high rainfall. These factors also influence plant growth. The Natural Resource Organization in 1993 has categorized Rangelands of the area into 4 ecological zones based on ecological factors such as plant species, type of the soil, grazing seasons and so on. More information on each category is presented on the following table:

Type of Rangeland	Percentage of total Semnan Rangeland	Location	Percentage of vegetation cover	Dry matter yields per hectare
Good rangeland (score 1)	5%	The North of the province	76%-100%	Up to 500 kg
Medium rangeland (score 2)	28%	At the altitude between 1800 and 2000	51%-75%	250kg-500 kg
Poor rangeland (score3)	36.75%	The south of the area	26%-50%	100-150kg
Very poor rangeland (score4)	30.20%	At the southernmost tip of the area	Below 25 %	50kg-60kg

**Table 8: Information on each ecological category of Semnan rangeland** (Badripour, Eskandari et al. 2006)

## **2.3 Land use Management**

### ***Formal forms of property rights in the Semnan province***

Three forms of property rights are ??:

- ***State property rights:*** Some regions of Semnan, like other areas over Iran, have been appropriated by government organizations and are effectively used for livestock and crop production. One reason for this being successful is because monitoring officers who protect the land from overgrazing in the growing seasons. In addition, a number of fertility

improvement projects have been running in these lands. Therefore, these lands are managed more effectively as compared with the other common lands (Ghandali 2001).

- ***Common property rights***: In this system, a group of land users has received either a grazing license or RMP issued by the Natural Resources Organization for a given zone, but the number of livestock that can be grazed by each member of the group is specified. The group often determines the boundaries of the land used by each member. The number of appropriators having a grazing license for winter grounds is often more than those for summer grounds. Members of the given group can rent out their rights to others. Until 1995, community members could transfer their rights to a person outside the group. Now because of overgrazing, community members can legally transfer their rights only with the others within the community.
- ***Private property rights***: In the regions under this system, landholders have individual grazing permits.

Additionally, many lands (more than 80 percent) are managed under non-industrial systems of livestock raising, and there is still priority of extensive system of management characterized by low inputs, poor husbandry systems, poor nutrition and poor marketing systems (Salmasi Dehghan 1995).

For all non-governmental rangelands, the Office of Natural Resource allocates either Grazing Licenses or RMPs. Table 9 illustrates distribution of grazing allocations in the Semnan province:

City	Nr. of allocation parcels	Nr. of allocation parcels under RMP	Nr. of allocation parcels under a grazing license
Semnan	437	184	253
Shahrood	606	99	507
Garmsar	77	47	30
Damghan	130	76	54

**Table 9: Distribution of grazing allocations in the Semnan province (Sanadgol 2008)**

### ***Different types of livestock movement in Semnan***

The following types of livestock movement are described as follows:

- ***Semi-Nomadism.*** In this system, in the summer time, all nomad households move to the summer grounds, and stay for 90-100 days. They yield dairy products during their stay in the summer grounds. In the winter months, they graze their livestock on the lands near to the villages as well as using silage. These communities are more or less equally distributed across the province.
- ***Transhumance.*** In this system, similar to the previous form, livestock herd is taken to summer grounds, and the households also move to these regions. While, in the winter season, herders employ shepherds to take their livestock to winter grounds far away from their villages.
- ***Mokhtabadi.*** This system is only found in Semnan. Mokhtabad comes from the name of the people, who are expert in producing dairy products. In fact, this area in Iran is well-known in terms of quality and variation in dairy products; nearly 22 types of dairy products were recognized to be produce by Semnan pastoralists (Shahosseini 2001). Livestock holders accompany the shepherds to summer grounds. Unlike the other systems, in this system women are not involved in livestock production.
- ***Sedentrization.*** In this system, there is no mobility and livestock producers graze their flocks only on the lands near to their settlement. In addition, they use other livestock feed sources such as dried hay.

According to Salmasi (1995), the level of community cooperation with state plans for protecting and recovering the area from degradation has been more effective in comparison with other provinces. For instance, degree of community cooperation<sup>32</sup> for sedentary systems was 27.5 percent, for farming transhumant 52.3 percent, and for nomad systems 37.8 percent.

### ***Pros and Cons of RMP***

The RMP plan has achieved some positive outcomes, especially ecological benefits on the plant vegetation for the rangelands located in the Semnan province (Badripour, Eskandari et al. 2006; Arzani et al. 2007). Nevertheless, the plan has faced some problems and has been also criticized (Arzani et al. 2007; Hedjazi 2007).

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<sup>32</sup> The degree of community cooperation was estimated based on the average percentage of a local community who participated in the meetings.

<i>Reasons for unsuccessfulness of rangeland plans</i>	<i>Frequency Percentage</i>	<i>Reasons for successfulness of rangeland plans</i>	<i>Frequency Percentage</i>
The lack of following seriously objects of the plans by executive	26	Hardworking and persevering executive	25.3
The lack of financial support	8.6	Continued aids and controlling the running of plans by natural resource scholars	20.8
Unclear boundaries within the users ' group	8.6	Lack of conflicts among local executives	10.4
The lack of adequate investment to run the basic parts of the plans by executive	21.7	Providing financial requirements	8.9
Plan objects do not meet short-term expected benefits to land users	4.3	Enforcing the main part of the given plan by only one person	5.9
Insufficient trainings to pastoralists	4.3	An effective relationship among enforcers, scholars, and stockholders	5.9
The lack of cooperative unions for helping stakeholders	4.3	Providing sufficient instruments such as infrastructure when they were needed	4.4
Others	13.6	Accurate economical interpretation of the given plan before implementation	4.4
		Appropriateness of environmental condition	2.9
		Multi-objectives following by one project	1.4
		Others	

**Table 10: Reasons for successfulness and unsuccessfulness of RMPs in the Damghan city of Semnan (Salmasi Dehghan 1995)**

According to a report from the Technical Office (1997 cited in Salmasi Dehghan (1995), group executives<sup>33</sup> played the main role in the successfulness or unsuccessfulness of implementing the RMP. The report was based on a study of

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<sup>33</sup> the group executive is a group representative who was intermediary between the governmental organization and user group

the overall 35 rangeland plans conducted by state organizations in Damghan city of Semnan Province, 18 plans were effective, while 17 were not. The following table represents the reasons for successfulness and unsuccessfulness of the RMP.

### **3 The two study region within the counties of Semnan and Damghan**

For the purpose of investigating deeply into the RMP integration, the two counties of Damghan and Semnan have been selected, mainly because of the rich datasets available that include information about socio-economic characteristics of the rangeland holders and ecological condition of the study parcels of rangelands.

#### **3.1 Geographical condition of Damghan and Semnan**

Among the four counties, Semnan with the extent of 22.191 km<sup>2</sup> covers 22.76 percent of the province, and Damghan with the extent of 14.025 km<sup>2</sup> covers 14.36 percent of the province. A main part of the county of Damghan is influenced by the wintry winds, which come from the north. Therefore, it is cold during the winter, with an average temperature of 5°, and mild in the summer with an average temperature of about 25°. While Semnan is mild in the winter with an average of temperature of 8.6°, and hot in the summer with average temperature of 31°. The amount of annual rainfall is relatively similar for the two counties with an average amount of 150 mm. Nevertheless, variation in the rainfall is higher in Semnan than Damghan.

According to the last reported statistics (Statistical Centre of Iran 2007), Semnan and Damghan included 84,680 and 191,618 people of the province population, which consisted of 14.35 percent and 32.49 percent of the entire province population. Based on the country division, Damghan and Semnan are respectively comprised of 3 and 4 cities, 6 and 5 rural districts, and 629 and 726 villages. The Table 11 illustrates the county division of Damghan and Semnan in more details.

According to the Table 11, and with consideration to the extent of the two counties, Damghan and Semnan do not differ in terms of proportion of inhabited villages to un-inhabited villages. This refers to the fact that permanent



County	Extent (km <sup>2</sup> )	Number of cities	Number of rural districts	Villages			
				Number of inhabited villages	Number of un-inhabited villages	Total number of villages	% of un-inhabited villages to the total villages
Damghan	14,025	3	6	169	460	629	73.13
Semnan	22,191	4	5	210	516	726	71.07
The Province of Semnan	987,488	16	28	789	1,862	2,751	71.3

**Table 11: Structure data of Damghan and Semnan county** (Statistical Centre of Iran 2007)

immigration from village to city does not differ in the two areas. In both counties of Semnan and Damghan the high percentage of villages that have been converted to abandoned areas during the recent decades is considerable. In fact, Iran has one of the highest urban growth rates in the world. Many villages in Iran, especially those with a low population, have been transformed into completely abandoned areas in the recent decades (Iqtisad-e-Keshavarzi and Tose'eah 1995). For instance, between the years of 1996 and 2007, number of villages that lost their population has been raised at annual rate of 4.6 percent (Statistical Centre of Iran 2007). According to the studies on internal migration (Molaei, Santhapparaj et al. 2008) environmental degradation (shortage in natural resources) and higher expected income in urban areas are the two dominated factors that cause decrease in rural population, and ultimately transformation the villages into the abandoned places.

### 3.2 Economic situation in Semnan and Damghan

In the province of Semnan, like other provinces in Iran, the three sectors of agriculture, industry and services are the major sources of job providers. In the year 1995, the sectors of agriculture, industry and services provided 23.3 percent, 45.4 percent and 31.1 percent of the total employment in the province of Semnan (Statistical Centre of the Semnan Province 1995). After 10 years, the proportion of the industrial sector has been increased to 46.5 percent, while the share of agricultural activities has been diminished to 21.9 percent. In fact, in the recent decade, miners discovery of raw materials and establishment of small-scaled factories caused improvement in the industrial sector of the province. In the 2007,

the province was the first in producing chalk and salt, and the second in producing sulphate, sodium and coal (Statistical Centre of the Semnan Province 2007).

### ***Industry***

The impact of the establishment of industrial factories in the province generally improved conditions for the residents; however, not every county has developed in the same way. Among the four counties of the Semnan province, the county of Semnan due to its location and the quality of its mineral resources was the most interesting for investors to establish factories. The Semnan County is located in the middle of the province, which is close to the larger neighbouring provinces and Tehran, the capital of Iran. In fact, the special location of the Semnan County caused this area to be called for the capital of the province; even though it is not the biggest neither in the population nor in the extent. Moreover, good quality of mineral resources in this area caused the highest investment in mineral exploitation to be allocated, while other areas, such as Damghan, were more abundant in miners.

More than half of the recent factories in Semnan were established in the small form with traditional or semi-modern technology. As the small-scale factories required unskilled workers, many factories have been established in the rural areas in the search of cheaper labour. Therefore, among the three sectors of employment, agriculture and industry have become the two important sectors that provide employment facilities for the villages of the province. In 2007, agricultural activities—that include farming, horticulture, animal raising, honey production and fishery—and industrial activities allocated 54.6 percent and 34.6 percent of the total employment in the rural areas of Semnan province (Statistical Centre of the Semnan Province 2007). The establishment of industrial factories has generally reduced the availability of employment in agriculture. Many agricultural producers, especially those from villages where that had been transformed to “industrial areas,” shifted the main source of income from agriculture to the industry.

Industrial investment in rural areas causes changes in the economic situation of the villages, including employment structure, productivity of agricultural products and educational level of agricultural workers. In the rural areas, provision of employment facilities other than agriculture, causes the small agricultural workers to shift their main source of incomes from agriculture to those occupations. Small agricultural workers are here defined as those workers who earn their marginal

incomes from agricultural products and some simple non-agricultural products such as handicrafts and food processing for the village consumption. Some of them own small farm or have right to use a parcel of rangeland. The growth of manufacturing employment provides the opportunity for them to earn more income. If their income of the new occupation were high enough compared to the previous one, they might leave their agricultural occupation, and thus either release or rent their lands to other agricultural workers. In this situation, major agricultural workers are likely to be the first demanders for renting their lands. In fact, the impact of development rural industry can show itself in the two parts of transforming small agricultural workers to manufacturing employment and transferring the main part of producing agricultural products to the major agricultural producers. The major agricultural workers are here defined as those who are mainly interested in increasing their agricultural productions, and have more financial ability to try the new methods of agricultural production including the improved seed variety and agricultural machinery. As most technical advanced methods in agricultural production required to be applied in a large scale, the major agricultural producers are supposed to be the first demanders for renting agricultural lands from small workers. Ultimately, assuming that the impact of growth of manufacturing employment goes to this direction, the result associated to the agricultural products unfolds in the form of economics of scale by which the productivity of agricultural production may expand, while the number of producers may diminish.

In our study area, we expect the county of Semnan with a significantly higher growth of manufacturing employment compared to Damghan, has a higher productivity of agricultural products. Furthermore, application of technology in agricultural production requires education and those skills associated to this form of employment. Therefore, a higher level of education of agricultural workers in Semnan might be another result of the growth of manufacturing employment in Semnan compared to Damghan.

### ***Rural industry in Semnan and Damghan***

The following represents the impact of developing rural industry in the two counties of Semnan and Damghan by using records of the two sectors of industry and agriculture. The statistics for employment was not available for rural areas in detail. We begin comparing the industrial sector in the two counties of Semnan

and Damghan, and then go further to agricultural sector to figure out the general impact of developing industrial sector on the agricultural sector.

Before comparing the industrial sector in the two counties of Semnan, it is worth mentioning that 95 percent of the industrial factors were established and managed by the private sector (Statistical Centre of the Semnan Province 2007). The study (Valadkhani A. 2004) illustrated that private investments in Iran are more efficient, especially in terms of number of employees, than the government investments. It is therefore expected that the industrial investment in the study region is profitable in the long term, and the created opportunities of employment to be sustainable for the long term.

The Statistical Centre of Iran<sup>34</sup> divides the industry into the three sectors of large-scale industry<sup>35</sup>, middle scaled industry<sup>36</sup> and small-scale industry. According to the definition, small-scaled industries are those with less than 50 employees. In Iran, in addition to the number of employees, the small-scaled industries are considered incompatible with modern technology, and thus the main part of their employees is supposed to be un-skilled. This type of industry has relatively little specialization in management, and has closer integration with rural communities compared to the big and the middle scale industries. Therefore, they are supposed to provide more employment facilities to rural communities. The following tables illustrate the total number of industrial units in different scales (see

Table 12) as well as the population employed in these industrial units (see Table 13) for the two counties of Semnan and Damghan in 2007.

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<sup>34</sup> Countries use different criteria to define different scales of their industry. Some use the extent of the market they industry use or amount of investment, physical technology of production and social technology of management. Among the used criteria, number of employees is the most common criteria used by specialists and the governments. In Iran, this criteria is used not only because this data is easier to be gathered, but because it is closely linked to the industrialization. Most small-scale enterprises are in traditional industries and engaged in the production of consumer goods and services. While big scale enterprises use modern technology and outputs from small-scale factories.

<sup>35</sup> Big-scaled industry is defined as those with more than hundred employees. Beyond the number of employees, this type of industry is considered as using modern technology.

<sup>36</sup> Middle-scaled industry is defined as those with the number of employees between 50 and 99. This type of industry is considered as using semi-modern technology.

County	(% in the province)			Extent of the area (km <sup>2</sup> )	Number of inhabited villages
	Small scale industry	Middle scale industry	Big scale industry Number of units		
Damghan	32 (6.39%)	1 (1.5%)	6 (10%)	14,025 (14.39%)	169 (21.42%)
Semnan	244 (48.7%)	23 (35.38%)	21 (35%)	22,191 (22.76%)	210 (26.61%)
The province	501	65	60	97,488	789

**Table 12: Number of industrial units in different scales** (Statistical Centre of the Semnan Province 2007)

Table 12 illustrates that Semnan, with occupation of less than 25 percent of the province and allocation of more than one-third of the industrial units, can be attributed to the industrial polar of the province. While the development of industrial centres in Damghna, with occupation of about 15 percent of the entire province and allocation of less than 10 percent of the industrial units, was not dramatic. In addition, about 85 percent of the industrial centres in Semnan has been established in the small scaled forms which are assumed to provide a considerable non-farm employment opportunities for rural people. In order to have a better understanding of the industrial development in the two counties of Semnan and Damghan, the following table represents the employment of the industrial sector for the two counties of Semnan and Damghan.

The mentioned results from the previous table can also be seen in Table 13. The Table 13 illustrates that more than 50 percent of employees in Semnan worked for the industrial sector. In addition, more than 30 percent of the industrial employees in the entire province are from the county of Semnan. While in the county of Damghan, with less than 20 percent of employees engaged in the industry, absorbed about 13 percent of the total industrial employees in the province. The table shows that although number of miners in the two regions is high, they absorbed a small part of employment in the two regions.

	Population of employees (% within the county employment)			Miners		Total employment population
	Small scale industry	Middle scale industry	Big scale industry	Nr. of miners	Nr. of employees	
Damghan	812 (3.5%)	76 (0.33%)	1,606 (6.1%)	31	476 (2.07%)	22,970
Semnan	9,780 (16.7%)	1935 (3.3%)	7,395 (12.63%)	60	491 (0.84%)	58,568
The province	11,111 (6.3%)	4,307 (2.4%)	13,833 (7.8%)	171	2,539 (1.44%)	176,734

**Table 13: Number of employees in industrial units** (Statistical Centre of the Semnan Province 2007)

### ***Agricultural production***

The lack of dynamic data on agricultural products makes it difficult to clarify the trend of this sector in the last decade. Nevertheless, studying statistics on agricultural sector in the same year as we did for industrial sector may clarify tendency of agricultural activities in the two study regions with different growth of industrial development.

In the 2007 agricultural sector, Damghan employed about 20 percent of the total agricultural workers in the province. Semnan, with employment population more than 2.5 compared to Damghan, employed about 16 percent of the agricultural workers in the province. In addition, in the same year about 47 percent of the employees in the county of Damghan worked for the agricultural sector, while it was about 15 percent for the Semnan employees (Statistical Centre of the Semnan Province 2007). It can be concluded that agriculture is the most important source of employment in Damghan, while in Semnan it does not play such an important role. Nevertheless, according to the previous discussion, the impact of industrial development may show itself in the productivity of agricultural firms, which is called “agricultural units.” Before going through the productivity, first we represent the number of units for each sub-groups of the agricultural sector.

County	Number of farms	Number of gardens <sup>1</sup>	Number of conservatory	Unites of raising <b>big livestock</b> (including cattle and camel)	Unites of raising <b>small livestock</b> (such as sheep & goats)	<b>Other</b> unites (honey bees, poultry & silkworm)	Total units
Damghan	2,740	5,987	4	524	3,081	2,083	14,419
Semnan	3,806	3,440	45	1710	2,014	1,748	12,763
The Province	21,991	21,233	109	7,697	14,942	13,526	79,498

**Table 14: Structural data of agriculture sector in the counties of Damghan and Semnan** (Statistical Centre of the Semnan Province 2007)

The Table 14 illustrates that in both study regions, livestock and farming products are the two major sub-products of the agriculture sector. Therefore, we will mainly focus on these two products. For the livestock products, the table shows that Semnan was dominated by the raising of large livestock<sup>37</sup>, while Damghan raise small livestock. According to the table, 22.21 percent of units of raising big livestock in the whole province were kept in Semnan, while 6.8 percent were in Damghan. Additionally, 21.29 percent of the province units of raising small livestock were held in Damghan, while 13.48 percent were in Semnan.

The large proportion of units for raising cattle in Semnan compared to Damghan, illustrates briefly that Semnan is less dependent on rangeland resources and is more industrialized, even in producing livestock. In Iran, a large proportion of units for raising cattle (about 95 percent), according to Badripour, Eskandari (2006), were either completely<sup>38</sup> or relatively<sup>39</sup> industrialized. Even those units of raising cattle that are under extensive management have a little dependency on the rangeland resources due to the low vegetation density of semi-arid rangelands. A

<sup>37</sup> In the Semnan province, like many other provinces, the units of raising big livestock are used, mainly for cattle than camel, of units for raising big livestock, about 98% in Semnan and 94.46% in Damghan are used for cattle.

<sup>38</sup> Cattle is the only livestock under the industrial system. The cattle under this system are kept in industrial units and modern barns. They are not dependant on rangeland resources, and are completely fed by cultivated fodder, supplements and imported feed. The cattle are regularly used veterinary and sanitation services. Both meat and dairy products are produced under this system and sell by using marketing plans.

<sup>39</sup> This system is relatively similar to the previous system, except that cattle under this system are somehow related to rangelands. In some days of a year, they are held on the farms or grazed on the rangelands nearby, as they can not move far away from their holding shed.

rural native cattle depended on the rangeland for about 27.6 Kg Total Digestible Nutrient which is equal to 10 percent of its yearly feed requirements. However, small livestock including sheep and goat were more dependants on rangeland, compared to big animals. The degrees of dependency on rangeland for small livestock rely on the type of livestock, which is here sheep or goat, and the system under which the livestock are managed. Generally, a goat, compared to a sheep, is more dependant (about 1.2 times) on rangeland resources (Badripour, Eskandari et al. 2006). Although for raising small livestock in the province there was no complete industrial units as it was for raising cattle; industry-made feed influenced the livestock dependency on rangeland resources (Badripour, Eskandari et al. 2006). Introduction of feed concentrates and sophisticated additives caused less and less dependency of livestock on locally available feed resources. Therefore, using these artificial feeds increase the capacity of keeping more livestock. For rangelands with the same condition in terms of resource productivity, the more use of the industrial made feed increases the livestock density is expected. The following table illustrates numbers of livestock in the two counties of Semnan and Damghan, and the average density of livestock per a unit.

The county	Sheep		Goat		Cattle		Camel	
	Number of livestock	Average density per a unit	Number of livestock	Average density per a unit	Number of livestock	Average density per a unit	Number of livestock	Average density per a unit
Damghan	68,760	44	48,190	32	4,445	9	808	28
Semnan	211,535	147	35,075	61	19,738	12	1,045	32
The province	561,275	65	221,535	35	57,885	8	5,100	17

**Table 15: Number of livestock in the counties of Damghan and Semnan** (Statistical Centre of the Semnan Province 2007)

The Table 15 illustrates that there was no significant difference in livestock density for cattle and camel, referring to the fact that rearing the big livestock were restricted by the same system in the two counties. For sheep and goat, averages of livestock densities were significantly different between Damghan and Semnan, referring to the fact that in Damghan, rangeland resources restricted the



rearing the small livestock. From the discussed results, it can be concluded that in Semnan raising livestock, even small ones, used more technological advances.

### ***Farm products***

In order to have a brief study of agricultural productivity, we concentrate more on the wheat and corn, which are the main agricultural products. The Table 16 illustrates both cultivated area and dry area of the two products as well as the productivity of them in the two counties of Semnan and Damghan.

Obviously, the productivity of wheat and corn depends on many ecological factors, and not only using the technological advances including improved seed varieties and fertilisers. Nevertheless, the significant differences in the productivity of agricultural products between the two study regions might be the cause of engaging technological advances. In order to have more clarification on the extent of using technology in the two counties of Semnan and Damghan, we represent the last reported statistics on using agricultural machinery in the three

	Wheat					Barely				
	Extent of the cultivated area			Productivity in a hectare		Extent of the cultivated area			Productivity in a hectare	
	Total	Irrigated farming	Dry farming	Dry farming	Irrigated farming	Total	Irrigated farming	Dry farming	Dry farming	Irrigated farming
Damghan	4,570	4,567			2,074	2,074	2,036	105	742	2,752
Semnan	3,442	3,340	102	450	4,692	1,614	1,508	38	666	3,963
The province	34,774	7,387	27,387		3,571	16,694	13,659	3,035	989	3,388

**Table 16: Wheat and corn production in the counties of Damghan and Semnan**  
(Statistical Centre of the Semnan Province 2007)

stages of the plantation process. The Table 17 confirms the previous result that the two counties vary from each other in terms of using technological farming machineries. The recorded statistics illustrates that while only 5 percent of farms in Damghan used farming machines in all three stages of plantation, in Semnan 47 percent of farms used the machines.

	Total number of units	The whole process	Planting seed	Cultivating	Harvesting
Damghan	2,740	137	1,096	548	1,098
Semnan	3,806	1789	2,283	1598	2,854
Total	21,991	4398	9,016	7,696	10,995

**Table 17: Agricultural machinery in the counties of Damghan and Semnan**  
(Statistical Centre of the Semnan Province 2007)

In addition, the statistics show that in maximum 40 percent of farms in Damghan used machines for at least one stage of the plantation process, while in Semnan more than 70 percent of farms used agricultural machines for at least one stage of the plantation process. Additionally, agricultural farms tended to be bigger in Semnan than Damghan, and the average extent of irrigated units in Semnan is 2.4 times bigger than Damghan (Statistical Centre of the Semnan Province 2007).

### 3.3 Level of education

We expect that changes in the employment facilities, which, according to the mentioned information, influenced the process of producing farm products, may generally affect the educational level of employment in the relevant villages. The following Table 18 illustrates the last reported statistics in 2007, on the educational level of the employment population for the two study regions of Damghan and Semnan.

	Total population in the county	Total population in the rural areas	Within employment population					
			Total employment population in the rural areas	% of the employment population in the rural areas	Illiterate population	% of the illiterate population	Population who were trained/educated in a specific field of study	% of the educated population
Damghan	84,680	21,095	3,995	18.94%	958	23.98%	995	24.9%
Semnan	191,618	27,358	10,399	38.01%	2,287	21.99%	7,071	67.99%
The province	589,742	149,183	37,299	25%	9,325	25%	12,310	33%

**Table 18: Educational level of the employment population** (Statistical Centre of the Semnan Province 2007)

Rural areas in the two counties do not differ in the proportion of illiterate employees; even no difference between the two counties with the percentage of the entire province. Nevertheless, the information show that a significant percentage of employees in Semnan have been either trained or educated in a specific field. It is concluded that the employment population in Semnan is more specialized to their field than the employment in Damghan. It seems that in Semnan, the rapid growth of industrial centres and the introduction of the economics of scale in agriculture persuades the employed workers to learn the required skills.

#### **4 Summary: Similarities and differences in the structure of the two counties**

From the discussed background, it is concluded that the two counties of Semnan and Damghan are not significantly different in the general condition of their rangelands, while they are significantly different in their economic situation. In fact, the special location of the Semnan county as well as the high quality of its mineral resources caused private investors to establish industrial centres. Many of these centres have been established in small-scale forms and nearby villages, in order to lower the cost of labour. Establishment of small-scaled factories in the Semnan County caused the increasing proportion of the industrial employment, improvement in the productivity of the agricultural units and more tendencies toward training programs. The expected economic benefits of implementing the RMP for the rangeland holders in Semnan and Damghan, as a result of varying situations, may differ. Therefore, the RMP integration may have followed different patterns.

One other possibility is that Semnan with the large size of the population and more employment opportunities may cause the community of rangeland holders to be fragmented in managing their rangelands, and thus the group users' communication could be very difficult.

In the following section, the hypothesis will be tested by measuring the degree at which the RMP has been adopted through the diffusion-adoption theory.

### III Methodology

#### 1 Structure of the empirical research

Chapter four starts with a description of the diffusion process of the RMP in the study area. After the analysis of regional differences, the so called *Bass model* is being introduced (see also chapter B II 4.1). The Bass model is used to estimate the coefficients related to the rates of adoption of the two study areas Semnan and Damghan to the RMP. The model describes the diffusion speed, at which the potential adopters implement the innovation. The speed is estimated via two coefficients

- *coefficient p* measuring the individual tendency to apply the innovation
- *coefficient q* measuring the influence of the former adopters on the potential adopters' to apply the innovation

Chapter five starts with a description of the land parcels in Semnan Province which are used for the analysis of the users' perspective towards the RMP. The study sample is described in terms of socio-demographic characteristics of the respondents ( $n = 70$ ). The users perspective of rangeland is presented in terms of landholders perception of the rangeland conditions and the purpose of land use. Several attributes are identified from the perspective of the users:

- advantages such as determination of land boundary
- disadvantages such as lack of accessibility, high adjustment costs and reduced income
- compatibility such as match of the plan with the traditions
- observability such as visible effects of the plan
- other factors such as drought and trust in the state system
- common ownership such as privatization

The chapter ends with a discussion on the main findings.

Chapter six starts with an overview of the history of rangeland management in the study area. Governmental campaigns and the reaction of the nomads on these campaigns are described. The analysis of current informal institutions results in the identification of reasons for rule establishment and the existence of sanctions.

The identified institutions for the study region are *strategies*. Chapter six ends with a conclusion of the main findings.

Chapter seven ties up with the classification of the previously identified informal strategies. The classification results in property in-use strategies, production in-use strategies and exclusion in-use strategies. Each strategy is described in detail in relation to the applied property rights in the study area. Paying attention to the group-established property strategies, the whole implemented system is called property in-use regime (PUR) in conclusion because the groups are actual regimes, governing the study parcels of rangeland. The four identified regimes are

- the unregulated common property regime (UCPR)
- the common property regime with rotational access (CR)
- the common property regime with a unique decision maker (CU)
- Mini common property regime (Mini)

In the following section, influential factors on the applied property in-use regimes are being identified. The influential factors are resource characteristics, village characteristics and group characteristics. In order to develop an indicator for the first factor – the resource characteristics – a factor analysis is being conducted on variables related to ecological conditions of the rangeland. In order to identify an impact of the rangeland on the applied property in use regimes a variance analysis (ANOVA) is carried out then. The variance analysis compares the means of variables in each defined case group to see whether there are differences in the groups. The variance analysis is used here to explore whether the applied property in use regimes are heterogenic in terms of the different characteristics e.g. winter, summer and spring rangeland (for resource characteristics), socio-demographic variables such as age, education, income and flock size (for group characteristics) and to demarcate the property in use regimes against each other.

The last part of chapter seven presents the model of property in use regimes in Semnan Province. The model includes the three scopes of characteristics identified in the previous section. The resource characteristics which are composed of factors for winter, summer and spring rangelands, and the group characteristics including factors for age, occupation, flock size and residence, and the village characteristics composed of factors for population density and type of village. A multinomial logit regression is used then to estimate the probability to select a property in use regime from the perspective of the users. The resulting key variables are population density, flock size and summer rangelands.

According to the results, the four previously identified regimes are analysed then again in terms of likelihood of implementation from the perspective of the users.

## **2 Methodology for section C IV ‘RMP diffusion in Semnan Province’**

To understand the RMP diffusion in the two counties of Semnan and Damghan appropriate, three sources of statistical data were used.

- The first source of the statistical data was used for the background description of the two study regions of Semnan and Damghan in 2007. This data information was obtained from the Statistical Centre of Tehran (SCT). The SCT is responsible for the collection of all demographic data associated with human population, public services and infrastructural facilities.
- The second sources of data were non-demographic data related to the agricultural activities and non-agricultural activities, especially industrial activities. The data related to the industrial activities was obtained from the Semnan Organization of Industries & Mines (SOIM) and the data related to the agricultural activities was collected from the Agricultural of Jihad Organization (AJO) in 2007.
- The third source of the statistical data was information on the number of rangeland parcels managed by either the RMP or the GL during the recent 25 years. This information was collected from the official sources available on the Technical Office of Rangeland (TOR) in Semnan.

The analysis of part four was based on the methodology of simple comparison for cross-sectional data sets related to the economic activities and estimation of the Bass model coefficients for the data related to the rangeland parcels. The Bass model describes the process of innovation diffusion through a community by estimating the two coefficients of “p” and “q”. The “p” coefficient explains individual tendency to apply the innovation (named ‘intrinsic tendency’). The “q” coefficient explains the influence of the former adopters on the potential adopters’ tendency to apply the innovation (named ‘social contagion’).

### **3 Methodology for section C V ‘The perspective of intermediary’s regarding RMP’**

#### ***Semi structured interviews***

Data collection in this phase of the study was based on semi-structured interviews. Since in explorative and descriptive studies, data collection is a critical part of the research process (Creswell 2003) <sup>40</sup>, the following techniques were used through the field study in order to obtain accurate data:

- The interviews were mostly conducted face-to-face and in natural setting at respondents’ home or office (Miles and Huberman 1994)
- Different techniques of inquiry including writing, drawing symbols and digital recording were used (Elmes, Kantowitz et al. 1995) <sup>41</sup>.
- The questions were revised as the important issues were clarified through the field study.

The questionnaire included two parts. The first part of the questionnaire focused on the overall question how rangeland holders use and manage their rangelands and water points. The stated questions referred to group accessibility, definite entrance and exit time for grazing, and other management regulations established by the user group. The second part was concerned with rangeland holders’ perspectives on rangeland management. Changes in rangelands’ conditions over time and individual appraisal of governmental rules were the main questions of this part. The majority of interviews were ended up with questions about off-livestock activities generating income and cooperative activities within the group.

#### ***Sample selection***

The respondents were selected from those rangeland users who held RMP for more than ten years. For 260 rangeland parcels located in two areas of Semnan Province, RMP had been prepared and submitted to the rangeland holders. 80 spots of these total rangelands were selected to collect data. The basis for sample selection was the duration of plan’s implementation that supposed to be more than ten years. For each rangeland parcel, at least one user, mostly “executive” who was intermediary between the governmental organization and user group, was

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<sup>40</sup> Cited in Hossain, D. M. (2008). Qualitative Research Process. Social Science Research Network, <http://ssrn.com/abstract=1287238>.

contacted by telephone to arrange a face-to-face interview. Some phone calls<sup>42</sup> were conducted by rangeland officers<sup>43</sup>, and the rest by the author. Some of the interviews conducted at the rangeland office (even for some in front of rangeland officer), while some others at the landholders places (their homes, lands or their working place if they had a second job). Over the course of eight weeks (March and April 2007), about 80 land executives were interviewed. Interviews were approximately 45 minutes in length and were recorded as digital files, except for three (these respondents denied to be recorded). Ten of those interviews conducted in the rangeland office and in front of rangeland officer were excluded from the analysis because the respondents were most probably influenced by the interviewing place, especially with regard to overgrazing and opinions on state rules and regulations. A total of 70 interviews were included in the data analysis. The respondents represented 65 rangeland spots. 35 of the land spots were used in summer, 30 land spots during winter time. All interviews were transcribed. The interview data were coded inductively (see Appendix 5). Categories which emerged during the analysis were clustered into conceptual groups. Percentages of responses shared among interviewees were calculated. In the end of the analysis, an SPSS file was generated from the coded data.

### ***Description of the sample***

All respondents were males. 17 of interviewed land managers used winter lands<sup>44</sup>, 26 used only summer lands and 27 used both, summer and winter lands. 67 of respondents were able to read and write; however they did not have an official certificate. The rest held elementary school certificates. 60 of the respondents were between 40 to 55 years of ages and the rest were between 25 and 40 years of age. All of the respondents had more than ten years experience in livestock husbandry. All of respondents had other occupation incomes to meet their family needs. Almost all (61) of respondents did agricultural activities beside livestock husbandry. Most (53) of those respondents who did both agricultural activities and livestock husbandry had other income sources beside farming and livestock rising.

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<sup>41</sup> Ibid.

<sup>42</sup> Unfortunately, the exact number was not recorded.

<sup>43</sup> Mr. Blouknejad, Rangeland Office (Edare Marta), Damghan, Semnan

Mr. Soltani, Rangeland Office (Edare Marta), Damghan, Semnan

Mr Rahai, Rangeland Office (Edare Marta), Semnan city, Semnan

<sup>44</sup> Winter lands are grazed in winter months. The condition of these lands is poor compared to the summer lands.



A few (9) of respondents did business other than farming beside livestock husbandry. Table 19 illustrates the demographic of respondents.

Type of the rangeland	Number of people
Users of winter lands	17
Users of summer lands	26
Users of both winter and summer lands	27
Education	
Ability to read and write	67
Elementary degrees	3
Age	
Between 40 and 55 years of age	60
Between 25 and 40 years of age	10
Other occupations the interviewers had, beside livestock husbandry <sup>45</sup>	
Agricultural activities	61
Other employment (in addition to farming)	53
Other employment (except for farming)	4

**Table 19: Demographic characteristics of respondents**

#### **4 Section C VI ‘Informal institutions in the study area: rules, norms or strategies’ and Section C VII ‘The property in-use regimes’**

The level at which decisions about resource use and property rights were made was the basis of the analysis in these two sections. Although grazing resources- pasture and water resources- are legally under state ownership; decisions on spatial and temporal access are almost entirely made by the group of rangeland holders who had legally the right of land use. Rangeland parcel (Samane Orfi) as a boundary for users’ group was therefore selected as unite of analysis. In order to capture probable impact of community characteristics on group decisions, all rangeland parcels in the study villages were investigated. Villages were selected based on their topographical location to be representatives of villages in high areas as well as low areas. Selection of the villages was conducted with the assistance of the Natural Resource Organization (NRO) due to budget limitation

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<sup>45</sup> Responses add up to more than 70 because some respondents had more than two occupations.

and insufficient knowledge of the author on the geographical condition of the area. The survey was directed at 28 villages included 138 rangeland parcels from two cities of Damghan and Semnan in the Semnan Province (in summer 2007).

The data collection was conducted in two phases. The first phase was based on structured interviews accomplished by at least one member of the target group. For each rangeland parcel in a village, at least one member was introduced by a student assistant<sup>46</sup>.

- In the beginning, the type of property rights for each sample rangeland parcel was appraised.
- This introductory part was followed by questions about grazing rules and regulations, the number of landholders and taken flocks to the rangelands.
- Questions about the number of rangeland holders with livestock and sizes of their flocks followed.
- The last part of the questionnaire was designed to collect socio-demographic data (see Appendix 2).

The second phase was a survey in official documents; especially RMP notebook (see appendix 3) and GL (see appendix 4). From these official documents, data were collected on the sample rangeland parcels, the quality assessment, the legal number of livestock taken to given rangeland spot, and the official number of landholders and appropriate grazing time. The analysis included a historical review of the main policies imposed by the government during the 25 years.

The study villages differ in terms of their geographical location. 14, 11 and two villages are located in the mountainous, flat and valley regions, respectively. Almost all of the villages were used for permanent settlement and only one village was used for seasonal accommodation for seven months<sup>47</sup> of a year. 13 of the villages had shops for buying necessary tools; nonetheless residents from almost all villages were used to go to close cities for buying a part of their requirements. Ten villages were also used by residents from other villages to purchase their living needs. 18 villages had elementary school, while only four villages had all levels of schooling in their villages (detailed description in the Appendix). Village council, Agriculture-Jihad Centre and Cooperative Village Council that are

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<sup>46</sup> The interviews conducted by Mr. Akbari. He lived in a village of Semnan province and was a student in the field of Natural Resource.

<sup>47</sup> The village residents usually come on March and leave the village on September.

centers for governmental services were active in most villages and there were only two villages in which the government had no centre. All villages had access to electrical power and drinking water from piped. 13 villages had access to public transportation. Detailed description of the study villages appear in appendix. 9 to 18

## **5 Some critical remarks about problems related to the field study**

One of the main problems of this study was realized doing interviews that even changed the study approach. To do the first round of interview, a three pages questionnaire was prepared based on the theories and literature review on the study area and other region with the similar problem of rangeland degradation. Preparing this questionnaire took about one and half month without considering the time spent for studying literature and understanding the relevant theory. Having a very nice-prepared questionnaire, we were quite optimistic that I will collect the most relevant and accurate information from the field.

As we have never been in Semnan province, we asked the Natural Resource Organization (NRO) in Tehran to introduce me the most significant villages regarding livestock husbandry, and to help getting contact with rangeland holders and livestock owners. After a few months of discussing about the research objectives and the type of information that is required, the NRO arranged dates and places appropriate for the field study. To reach the places, we were told to contact the Technical Office of Rangeland (TOR) in Semnan.

From the three first interviews, we found that some of the basic questions were quite confusing for the respondents. We spent time clarifying the meaning of the questions, but it was not helpful. For instance, we tried to ask them about the community boundaries by different ways, but all were not understandable for them. Therefore, after the three first interviews, we changed these questions to open questions, and tried to understand the important things associated with rangeland management as well as the important things for the rangeland holders. The results obtained from these questions made the basic framework for preparing the questionnaire for the second round.

One other problem was related to the culture of the region. Being a woman, asking about men's job, they were uncertain whether they should talk to me or not. This happened especially when I was asking whether they followed the

official regulations. I also faced periods of silence during the interviews. This silence was either because of not understanding the question or because they were considering whether they have to answer and how to answer. Understanding whether the break meant a lack of understanding or whether they were thinking about the response were something I came to learn during the study. To solve the problem, I attempted to make contact with some local people to ask for help.

Fortunately, I found a person who helped me to make the integration easier. Before doing the interview, he introduced me to the respondents and explained what I was planning to do. Most of them agreed to participate in the study without asking a question, and some of them were clearly interested in talking to me.

Sometimes, I faced the problem of being understood as an officer. Some respondents thought that I am an officer who is searching for the problems; therefore they attempted to convince me that they have so many problems, especially in finance.

## **IV Results 1: RMP Diffusion in the study area**

### **1 Objective and theoretical frame**

#### ***Objectives***

The objective of this section is to analyse the diffusion process and the diffusion speed of the RMP in Semnan Province.

To understand this process within the local communities, it is initially important to address how the Rangeland management Plan (RMP) was introduced and implemented by the local communities. RMP was initially introduced by the rangeland office as part of a new strategy aimed at tackling the problem of rangeland degradation and improving rangeland conditions within a long term.

The theory of “diffusion of innovation” which is used in this phase of analysis, defines “any new idea, practice or object that is perceived as new by individuals or other users” as an innovation (Rogers 2003 see also chapter B 4.1). Therefore in this study we consider the RMP as an innovation that was introduced from outside of the society to the local users.

Innovation can be a cause of scientific development that is called as “Technology Push Hypothesis.” By this hypothesis, scientific development which brought the innovation in to the society may not be on the same path as the users’ needs, but the needs for the innovation are animated ex-post. Furthermore the theory of “demand pull hypothesis” is another reason for creation of an innovation. Based on “demand pull hypothesis“, people’s demand for a new strategy or product leads to creation of an innovation (Plieninger et al. 2007). From the two hypotheses, it is concluded that RMP creation is more associated with the second hypotheses, in the way that the problem of resource degradation caused the creation of RMP innovation. Nevertheless the RMP was not created by the community of rangeland holders who were the main dealers with the problem of resource depletion. The rangeland office created this system due to its indirect engagement with the problem of rangeland depletion.

### ***Theoretical frame***

As described in chapter B 4.1, the initial purpose of introduction of an innovation into the society influences the diffusion process. The diffusion process is considered as the five stages which are defined based on the percentage of the target members who adopted the innovation. According to Rogers (2003), the potential adopters, and thus the five stages, are classified into five groups of

- Innovators: the first 2.5 percent of adopters.
- Early adopters: the next 13.5 percent of adopters.
- Early majority: the next 34 percent of adopters.
- Late majority: the next 34 percent of adopters.
- Laggards: the last 16 percent of the adopters.

The diffusion process is, in fact, transferring the innovation from one group to another group. The speed by which the innovation transfers into the groups is called “rate of diffusion.” Rate of diffusion differs for various types of innovations (Bruner 2004). Rogers (2003) describes the graphed curve of rate of diffusion as a S-shaped curve<sup>48</sup> on which the adoption of an innovation starts slow and gradual, and then grows rapid and eventually levels off and declines slightly. Furthermore, these different areas of the S-shaped curve are associated with different types of adopters. The area with slow and rapid slope, which is called origin phase, is linked to innovators and early adopters. The steeply sloping middle area of the curve, which is called diffusion phase, is linked to early and late majority adopters. The last horizontal tails, which is called saturation or equilibrium phase, is linked to the laggards. Among different phases of the diffusion process, the origin phase is given more consideration since it determines if the diffusion is likely to fail or succeed.

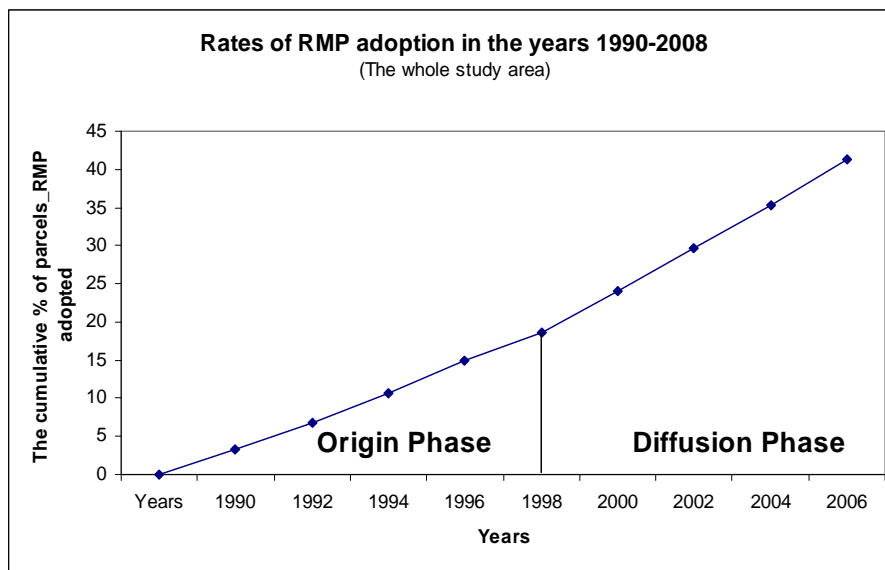
## **2 Diffusion process of RMP in both counties**

The following section discusses how the RMP has been diffused into the two study areas of Semnan and Damghan after the second introduction (between the years 1990-2008). The following figures illustrate the cumulative percentage of rangeland parcels which were under the RMP (Figure 8) and the yearly percentage

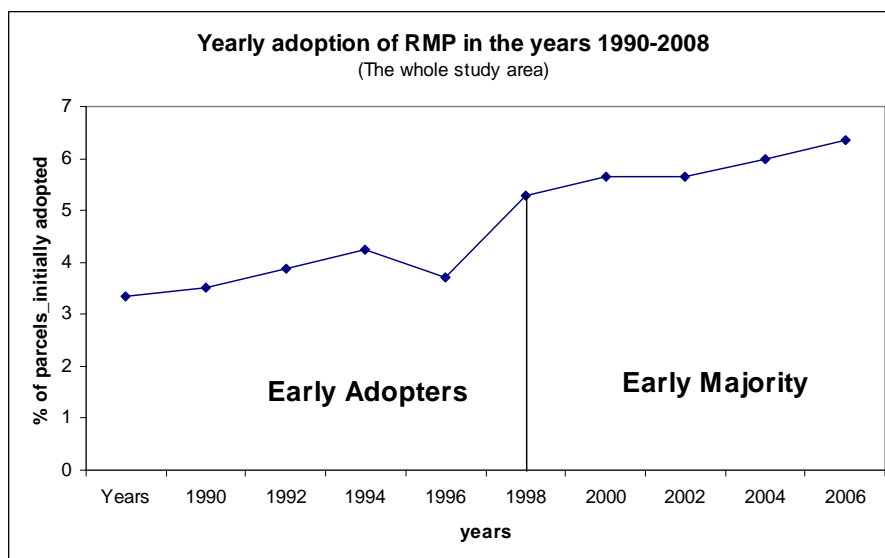
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<sup>48</sup> The curve is graphed the cumulative percentage of adopters over time. Based on the theory of rate of the diffusion, the curve is assumed to be slow at the start, more rapid as adoption increases and becomes gradually horizontal.

of rangeland parcels that were initially adopted by the RMP (Figure 9) during the years 1990-2008. It is worth mentioning that the results were more influenced by Semnan than Damghan, since Semnan parcels were bigger in the number of parcels than Damghan. The figures illustrate that the process did not follow the same trend as described by the diffusion theory. The percentage of adopters in 2008 showed that the diffusion process was in the second section “diffusion phase,” while the origin phase lasted about eight years.



**Figure 8: Rates of RMP adoption in the years 1990-2008 (The whole study area)**



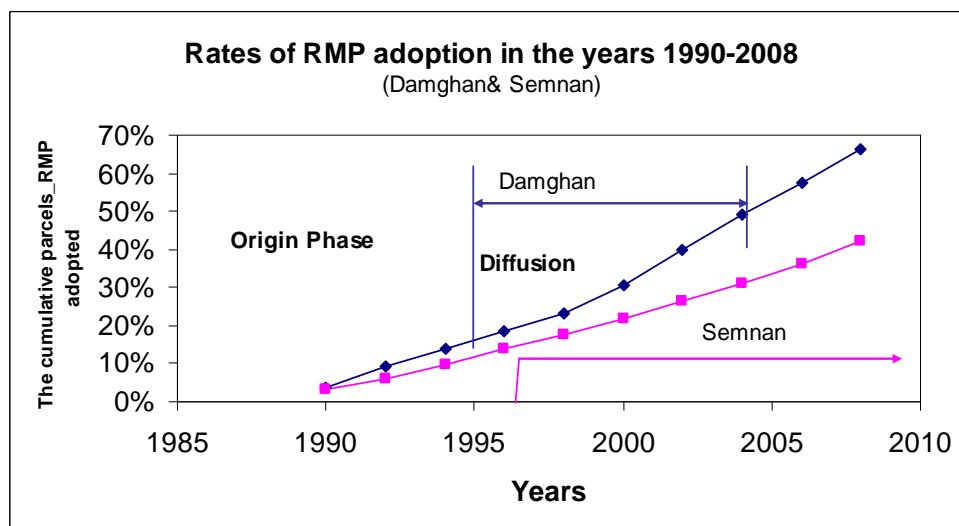
**Figure 9: Yearly adoption at RMP in the years 1990-2008 (The whole study area)**

The graphs show that the RMP diffusion developed slowly and even with a diminishing rate at the last years of the origin phase. Unlike the diffusion theory's description, there was no observation of a rapid implementation of RMP in either the origin phase or the diffusion phase<sup>49</sup>. The next section, by indicating differentiations between the two study areas, will clarify the RMP diffusion in more details.

### 3 Regional differences of the diffusion processes in the two counties

#### 3.1 Visualisation of diffusion patterns

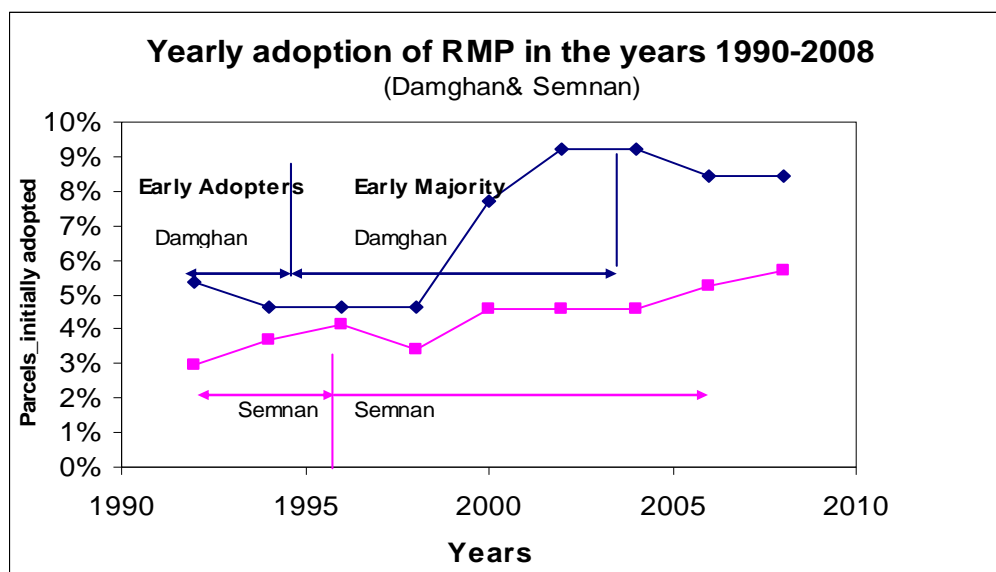
In this section, we discuss the diffusion patterns within the two study regions of Semnan and Damghan. We illustrate the general differences in the RMP diffusion for the both areas of Damghan and Semnan by using the graphs, showing the cumulative percentage of rangeland parcels under the RMP and the percentage of rangeland parcels that were initially adopted by the RMP during the years 1990-2008 (Figure 10 and Figure 11).



**Figure 10: Rates of RMP adoption in the years 1990-2008 (Damghan & Semnan)**

<sup>49</sup> Not having a rapid increase might be a cause of collective adoption than individual adoption.





**Figure 11: Yearly adoption of RMP in the years 1990-2008 (Damghan & Semnan)**

The pattern of diffusion in Damghan is similar to the theory of diffusion, as the diffusion begun slowly at the first phase and rising sharply over the increase of popularity. Whilst in Semnan the diffusion started slowly and tended to be stable during the second phase of diffusion. The two regions started with relatively the same intention/rate, as it is predicated by the theory of diffusion, describing most of innovations begun with a linear and slowly increase at the low levels of adoption. The theory describes that the greatest difference in the diffusion process of a particular innovation among heterogeneous zones occur in the most rapid rate of the second phase of diffusion. This is where the innovation is supposed to be spread among the group of early majority who determines whether the innovation will be diffused or rejected. In practice, in the two study areas of Semnan and Damghan, the two patterns of RMP diffusion became far from each other during the second phase of diffusion. In fact, after the year 2000 the RMP has been diffused quite faster in Damghan than Semnan, referring to the fact that the second phase of diffusion required a shorter time in Damghan than Semnan. In the year 2008, more than 60 percent of rangeland parcels in Damghan were covered by RMP, while 42 percent of rangeland parcels in Semnan were covered by RMP.

Figure 11 illustrates that the year 1998 is the crucial point of beginning dramatic development of RMP diffusion. After 1998, the RMP diffusion has been appeared to be particularly active in the two regions. 1998 showed major takeoffs, with slower diffusion in Semnan and rather rapid diffusion in Damghan. Ultimately,

the result shows that the most difference in the two patterns of the RMP diffusion appeared in the second phase.

### ***Equation of the RMP diffusion (Bass model)***

In order to indicate if the two different patterns are statistically different, we estimate the coefficients associated with the two curves by using the Bass model. The model was initially developed by Bass (1969) to describe the process of diffusion, and to forecast the new product sales. The model describes the diffusion speed, at which the potential adopters implement the innovation, by the two factors of “social contagion” (some authors consider these terms as “imitation impact” and “innovation impact”). The contagion factor, which is called parameter “q,” captures the extent at which the former adaptors influence the potential adopters’ tendency to implement the innovation. This tendency is mainly affected by exterior factors. The factor of “intrinsic tendency”, which is called parameter “p,” captures adopters’ natural tendency to implement the innovation. This tendency is mainly influence by interior factors (Bulte and Stremersch 2003).

According to Bass, we assume that the probability that a rangeland parcel is adopted at time T is a linear function of the number of previous adopted parcels. Thus,

$$A(P) = p + (q/m)P(P)$$

where

$A(P)$  is the number of adopted parcels at time T

$p, (q/m)$  are constants

$P(P)$  is the cumulative number of previous adopted parcels

By the model, and according to the Rogers’ definition (2003),  $p$  reflects the proportion of adopters who are innovators. The second part of the equation reflects the pressures from the actual adopters on the imitators. In order to develop a continuous model and a density function of time to initial adopted parcels, we define  $F(P)$  as the continuous probability density function of the adopted parcels and  $f(P)$  as the rate at which the probability of adoption is changing at a specific time. In order to estimate the function of  $F(P)$ , according to Bass, we define the conditional likelihood  $L(P)$  that a parcel will be adopted at the specific time T. Using the definitions of  $f(P)$  and  $F(P)$ , we will define  $F(P)$  as follows,

$$L(P) = f(P)/1 - F(P)$$

The probability of adoption at time T is

$$[f(P)]/[1 - F(P)] = Y(P) = p + q/mP(P)$$

$$f(P) = [p + q/mP(P)][1 - F(P)]$$

Where  $P(P) = mF(P)$  then the following function describes the number of adopted parcels at the specific time of T

$$S(P) = pm + (q - p)P(P) - q/m[P(P)]^2$$

Although the “p” and “q” are the two parameters describing the two main causes of diffusion, it is mathematically difficult to interpret the model parameters for any single diffusion curve. Any specific innovation might be caused by different assumptions and causal mechanisms that makes it difficult to understand which type of process is being captured in the equation. The two parameters can describe variation in diffusion patterns of any single innovation under different circumstances, for instance the diffusion of the same product in different areas. Furthermore, it is nearly difficult to interpret the numeric form of the two parameters. These two parameters address which causes, either the innovative or imitative, are more important on the process of the innovation diffusion. The coefficients show two factors have more influence on any particular pattern for the diffusion process of the innovation.

Table 20 illustrates estimation of the two coefficients “p” and “q” for Damghan, Semnan and the whole study area. Before going through the results, it is worth mentioning that estimation of the Bass parameters is generally influenced by the size of the data series. In fact, small samples of a short data series tend to underestimate “p,” and to overestimate “q.” We expect that the final results of our estimation were not influenced by size of samples, as the sizes of the three series were the same.

The estimation of the two parameters illustrate that the parameter “p” was significantly similar for the two counties, while the parameter “q” was significantly higher in Damghan than Semnan. This refers to the fact that the innovation impact played the same role for the whole study area, while the imitative impact was significantly higher in Damghan than Semnan. Similarity in innovative tendency refers to the fact that those adopters from each of the two regions, who have not applied for the RMP implementation in a certain time, have

the same intrinsic willingness. This tendency causes the potential adopters to decide independently whether to adopt or reject the RMP. By this tendency, people adopt the RMP because of being interested in implementing the RMP. Since the tendency is caused by exogenous factors including the RMP characteristics, it is concluded that the external factors have relatively similar influences on the RMP diffusion in Damghan and Semnan. On the contrast, the strongly imitative tendency in Damghan addresses that the internal influences played a more important role on diffusion of the RMP in Damghan than Semnan.

### Parameter Estimates

Parameter	Estimate	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
The entire study area				
p	0.030	0.003	0.024	0.035
q	0.176	0.014	0.145	0.208
Semnan				
p	0.028	0.002	0.023	0.034
q	0.191	0.018	0.149	0.233
Damghan				
p	0.031	0.007	0.015	0.048
q	1.221	0.139	0.902	1.541

**Table 20: Results of the regression analysis**

Bulte and Stremersch (2003) describe the imitative impact on the other way which is mainly used for new product diffusion. They interpreted the two mentioned tendencies as two types of communication channels: outside channel and inside channel. The outside channel, which is referred to innovative impact, includes the type of information, entering from outside of the community such as media broadcast. The most influential of this type of information on the diffusion process is on innovators who are adopted at the beginning of introduction of an innovation. The inside communication channel, which is referred to imitative

impact, is dealt with communication in-between the target adopters. Every group of adopter necessarily appears as a sender of information about the innovation, which can be positive or negative. This type of information from the prior adopters mainly influences imitators at the second phase of the diffusion process. By this definition, we conclude that the impact of external communication, such as the broadcasted information from the official resources, on the diffusion process was similar for the two regions of Semnan and Damghan. Nevertheless, the impact of inner communication among actual adopters and potential adopters was significantly positive in Damghan, while it was not significant in Semnan.

## **V Results 2: Users' perspectives towards RMP and the management of rangeland**

### **1 Research Question**

Although the process of RMP diffusion is important to be clarified; understanding how the RMP has been perceived by the actual adopters, as the main players, is also essential. The process of the RMP diffusion is laid in the second phase where the imitative impact plays the main role and potential adopters are mainly influenced by the actual adopters. Understanding the perception of actual adopters toward the RMP helps us to figure out which direction the diffusion process should be followed.

### **2 Methodology**

#### ***Data set***

We selected 80 land parcels of about 260 parcels located in the two areas of Semnan province. Sustainable range management plans for all spots were prepared by the governmental organization and submitted to the landholders. The basis of our selection was the duration of plans' implementation that supposed to be more than ten years. For each parcel of land, at least one was contacted by telephone to arrange a face-to-face interview. Over the course of eight weeks in 2007, about 70 land executives were interviewed. The respondents represented 65 rangeland spots. 35 of the land spots were used in the summer, while the rest (30 land spots) used in the winter. Interviews were approximately 45 minutes in length and were recorded as digital files, except for three that the interviewees did not want their voice to be recorded. Open-ended questions were used to figure out the barriers that the users face to implement RMP.<sup>50</sup>

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<sup>50</sup> For further details see chapter C III 3.

### ***Data evaluation***

All interviews were transcribed<sup>51</sup>. Transcriptions were read, to identify descriptive patterns and themes. A coding scheme was inductively identified and the transcriptions were coded based on this scheme. Descriptive themes were clustered into conceptual groups, mainly, based on the elements of diffusion theory addressed by Rogers (1995). An SPSS file was generated from the coded data. The actual explanation of the interviews – that is the words of the interviewees - is stated to highlight the users' perceptions of the sustainable range management plans. In order to provide an indicator of the degree to which the responses were shared among interviewees and to represent an easy-understandable analysis of community perception of the sustainable plans, the percentage of favourable perception to a given question are presented.

## **3 Users' perspectives of rangeland condition/management**

### **3.1 Landholders' perception of rangeland condition**

According to the literature on diffusion of an innovation, the first stage of adoption is recognition of the problem. This section documents interviewees' perception of rangeland conditions over the time as well as their explanations on the reasons behind their judgment. Almost all (96.7 percent) of the respondents indicated that rangeland conditions worsened over the recent decades. A few (3.3 percent) respondents claimed that rangeland conditions have been improved during recent years, although it has been damaged compared to the previous decades. All of the respondents who agreed with rangeland degradation denoted falling rainfall as a main cause for the range problem. More than one-third (34.15 percent) of these respondents indicated a reduction in annual rainfall as the only reason for rangeland degradation. More than a half (53 percent) of the interviewees described that although the amount of rainfall has played an important role in rangeland conditions, other factors such as governmental regulations, mainly land reform, and overgrazing have intensified land depletion. Table 21 provides more information on the causes of rangeland degradation, from the landholders' perspective.

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<sup>51</sup> Transcriptions can be found in Institute of Forestry Economics University Freiburg.

Items	% of cases
<b>Only rainfall reduction</b>	40
<b>In addition to rainfall reduction</b>	
Land reform	56.1
Weakness of the governmental enforcement	2.44
Conflicts among users' groups	2.44
Changes in the breed of livestock	4.74
Overgrazing	9.75

**Table 21: Land users' assessment of rangeland degradation (n = 70)<sup>52</sup>**

### 3.2 Landholders' purposes of land use

According to the literature on the diffusion and adoption theory, the second stage after knowledge about the problem and awareness of the new plan is persuasion in which the landholders assess favorable or unfavorable attitudes toward the innovation. Landholders' appraisals of the new program are remarkably influenced by their expectation in achievement of their goals using the new program. This section documents landholders' purposes of rangeland use. To figure out the respondents' goals of land management, they were asked about the reasons to do livestock husbandry and their intention for following that practice.

The majority (65.8 percent) of the interviewees indicated that livestock husbandry is their family job. More than a quarter (23.7 percent) of the respondents indicated that they were shepherds from their childhood and they are well acquainted with raising livestock.

*This is our family occupation. From the time I remember my father, grandfather and uncles did livestock husbandry. I grew up with sheep, goat, rangeland....*

*My father was a farmer, but I had to help him with our family expenses. I was a shepherd when I was a child. I took our neighbors' animals to plain out of our*

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<sup>52</sup> The total percentage is more than 100 as some respondents indicated more than one reason



*village.....I ‘ve continued this job for many years and now I wouldn’t be able to do other things better than I would do it...*

Only 10.5 percent of interviewees indicated their interest as the main reason for doing this job.

*I love sheep, goat...they are a part of my life. I would keep them, even if I were rich....I like being in the nature.*

The interviewees were also asked to express the reasons for following this job. As the table3 illustrates, almost half (44.2 percent) of the respondents indicated livestock husbandry as one of their income sources.

*It covers a part of our living costs. Although it is not the only source of income, it meets a part of our expenses. I know this job pretty well and it is too risky to leave it to do some thing else....*

Of the interviewees, 30.2 percent expressed their interest as the main reason for following this job.

*I will do it by the time I am alive. I love it, I learned it from my grandchildren and I will give it to my grandchildren, too. Hopefully, they know its value,...*

Of those who were interviewed, 16.3 percent described that they are economically satisfied with this job, whereas 9.3 percent said that they would lose their lands if they sell their flocks.

<b>Reasons for selection this job</b>	<b>% of cases</b>
Family job	65.8
Well- familiar with this occupation	23.7
Being interested	10.5
<b>Reasons for staying with this job</b>	
A source of family income	44.2
Being interest	30.2
Economical benefits	16.3
Maintaining the right to use the land	9.3

**Table 22: Main reasons for selecting the job/ staying with this job (n = 70)**

## **4 Attributes of RMP, from the users' perspectives**

### **4.1 The landholders' perceptions of RMP**

As outlined in the literature on the theory of diffusion-adoption of innovation, attitudes of an innovation including relative advantage, compatibility, complexity, observability and trialability influence the rate of adoption (vgl. Chapter B 4.1). In this section, we focus on interviewees' perceptions about RMP and the barriers that the landholders face to implement the RMP. To figure out the local barriers to apply the RMP, the interviewees were asked the problems they have with the RMP and their suggestion to improve the plans. The elements revealed by communities' survey were quite similar to those identified by the diffusion-adoption theory (vgl. chapter B 4.1).

More than a half (57 percent) of the interviewees disagreed with RMP and some claimed that the instructions of the RMP would damage land vegetation. Of the respondents, 26.2 percent completely agreed with the RMP. Only 16.2 percent of the interviewees indicated that RMPs would improve the land condition, if they were economically applicable to the landholders. The following section documents, mainly, the reasons that those who opposed RMP expressed.

### **4.2 Relative advantage/disadvantage**

Relative advantages and disadvantages is the extent to which potential adopters consider an innovation to be either a better or worse replacement for the pioneers. This section denotes relative advantages and disadvantages in the respondents' point of view.

#### ***RMP advantages***

Establishment of land boundaries for landholders or regulating land use was the only advantage indicated by just 10.5 percent of the total respondents.

*RMP helped us to exclude strangers from our property. After land reform, you could see people from other villages took their flocks to our lands, and we couldn't complain because they would say "it is public land". The RMPs enable us to kick strangers away ....the governmental organization will punish them if they do not respect.*

80 percent of those who mentioned determination of land boundary as a positive point for the RMP were the used summer lands. The Phi test of the two user groups indicated that there is a significant difference between the summer land users and the two other groups.

### ***RMP disadvantages - lack of accessibility to common lands***

Of those who responded, more than half (52.63 percent) indicated that they are not permitted through these plans to enter either their land or other common lands during non-grazing seasons. They said that two months of these four non-grazing months are in springtime during which taking flock to grass land is essential to livestock health.

*It is clear for everybody that sheep and goats should be in fresh air for at least four hours a day. In the springtime, they have to be out of the stable for at least four hours, otherwise they become ill. We [I] don't know how the government didn't think about this in RMPs. We cannot keep our [my] flock in the sky. We [I] have to have a place to take our[my] flock during spring and autumn.*

The percentage of those, who mentioned this problem, for the three groups were very similar, 61.5 percent for summer land users, 50 percent for winter land users and 56 percent for those who use both winter and summer lands. The Phi test did not show a significant difference among different groups.

### ***RMP disadvantages - high adjusted cost***

The majority (71.05 percent) of the respondents denoted that they are not able to meet all the fund requirements to implement the plans. They claimed that although the government committed to provide the adjusted requirements regarding financial sources, they were supported only for a few months.

*We do not have enough money to invest for these plans and official credits are not sufficient. Changing the system needs money.....*

63, 78 and 69 were the percentages of the respondents from groups using summer, winter and winter/summer lands, respectively, who referenced insufficiently governmental services as a main barrier to plans employment. The Phi test illustrated no significant difference between the three groups of land users.

### ***Economical disadvantages***

Of the total respondents, more than a half (52.63 percent) claimed that implementation of RMP would reduce their income from livestock because of an essential reduction in the size of the flock, the expensive price of hand feed and dried forage in non-grazing seasons and the low price of livestock at the selling season.

*The plan suggests us [me] to sell a part of my flock. That means my income would fall in the next year and the government doesn't give me any type of guarantee to compensate for that. This plan cannot bring any benefits to us [me] except for more expensive handing fodder in spring and losing a part of our [my] flock....*

## **5 Compatibility**

Compatibility is the extent to which potential adopters consider an innovation to be consistent with their values, experiences and needs. In this section, we focus on the RMP compatibility with traditional rules and regulations.

The majority (82 percent) of the total respondents indicate that the plans are not well matched with their traditions. Some interviewees commented that the RMP limited their traditional regulations in terms of the number of sheep and goats in a flock and grazing seasons for their lands.

*Before these plans, we had our own rules. In fact, all members were sensitive to their land protection. Before the grazing season, our father/elders gathered to decide when they go to the land and how many sheep every holder can bring to the land...these plans do not allow us to follow our way.*

Some other respondents claimed that RMP do not fit with rangeland vegetation. They believed that those officials who did not live in these areas and had little knowledge about the plants that cover their lands generate these plans.

*I grow up in this area. I know local names of each plants and my father told me about these plants. I know which plants would die during a drought, which are sensitive to water....my father always tell that number of sheep and goat that do not reduce plants. ....if the land is green, why we shouldn't let sheep feed.....*

The majority (more than 77 percent) of each three groups stated, at least, one of the mentioned aspects of incompatibility of the RMP with either social or ecological situation of the given area. The phi test did not illustrate significant differences among these users groups in terms of the similarities in their responds.

## 6 Observability

Observability is the extent to which potential users consider the results of the innovation visible.

Almost all of respondents claimed that they have not observed any area where land vegetation has been dramatically improved due to RMP implementation.

*We haven't seen any spot, neither in our village nor in neighbouring villages where it is better off because of these plans....the government tell always that these rules are good for the land, but nobody has seen...*

Only one respondent who used a summer land spot said that he observed ecological results of full/complete implementation of RMP.

*Yes, I have seen a land spot which quit green was. The area is not here. It is in the city where my cousin lives. I know all lands in this area are poor, and that was the only spot that I haven't seen even a small area without plants. I saw the owner and asked what he did.....he explained that, for more than ten years, he has been completely implementing the governmental plan. He sold a big part of his flock .....he told that he had no problem with financial investment...he had a good job and didn't need this income.*

## 7 Other factors

### *Drought*

Beside the mentioned factors related to the characteristics of the RMP, the land users indicated years of drought, distrust of governmental system and common ownership as the other obstacles to employ any type of systematic plans.

Almost all of the respondents (95.68 percent) indicated rainfall as an important factor for land production; however, 36.84 percent of whom expressed that any type of land management plans wouldn't improve rangeland condition due to unexpected droughts and variation in rainfall. According to Phi test, the

percentage of those who addressed drought and low rainfall as an important obstacle were similar.

### ***Suspicion of government's plans***

More than half (57 percent) of the respondents indicated, in different ways, that they do not trust the state system. They claimed that although at the time of issuance of the plans the government assured them that they would provide financial sources such as bank loan to change their management system. The government was supported for only a few months. They also claimed that the enforcement system was not effectively organized. They explained that within this system, the chance of getting caught for those violators whose lands are near highways is very high, while officials rarely inspect the remote lands.

*They expect us to invest a lot of money...The range office assured us to give bank loans and grants to run the projects, they didn't do that. I mean they did just for a few months.....*

### ***Common ownership***

Some respondents reported conflicts in groups due to common ownership as an obstacle to employ any type of systematic management plans. 24 percent of the total respondents indicated that privatization is the most effective solution to execute RMP. 89 percent of those who mentioned this problem used summer lands. The Phi test indicated a significant difference between the users group of summer lands with the two other groups.

## **8 Discussion**

Findings illustrate that most landholders in this area possess homogenous characteristic and are aware of significant degradation problems. However, there is consensus on rainfall reduction as a main factor for rangeland degradation, it is highly likely that a significant part of the people in this area do not believe in human impacts. In addition, findings illustrate that the majority of people believe, if no impact, negative effects of land reform on rangeland vegetation. The negative experience with the law of land reform might influence their judgment on any governmental policy regarding land management. Consideration of the goals of the landholders denotes that although obtaining economic benefits from

rangelands are not the only purpose of land use; provisions on the land use is a barrier for landholders to utilize the rangelands.

One of the main purposes of this study was to specify an in depth account of social obstacles that cause the landholders in the study area to have a low motivation to implement RMP, in spite of its positive impacts on land vegetation (Badripour et al 2006, Arzani et al 2007, Hedjazi 2007). Whereas, the theory of diffusion of an innovation provides considerable information about the factors influencing the rates at which a community accepts innovations, the study reported in this study attempts to look beyond the numbers to provide a more detailed account of the adoption phenomena from the perspectives of local managers.

Any generalization from this study to other regions, even in the same country, must be made with great caution due to differing situations. The elements determined in this study are similar to those reported by other studies conducted in other countries. In many studies on adoption of sustainable management programs (Sinden & King 1990, Carry & Wilkinson 1997, Abadi Ghadim et al 2005), relative advantages obtained from the implementation were emphasized as the main factor to local adoption. However, relative advantages can be attributed to different purposes such as economical, social and biological benefits; economic factor was underlined (Makeham & Malcolm 1993, Abedi Ghadimi et al 2005) as the most important element influencing the process of adoption of an innovation. The findings of this study illustrate relative disadvantages, such as lack of accessibility to the common lands during non-grazing seasons, high adjustment costs and decreased economical benefits, as important barriers, from the landholders' view of point, to use the management plans. However most of the interviewees did not mention economical benefits as their main objectives of rangeland use, they considered lack of economical profit as the shortcomings. Similar results are reported in the study carried out by Arzani et al (2007) in the same area. In their study, they assessed the average living cost of a household with the size of 5.4 persons and the net income of a flock with 100 sheep, also, of a flock with 100 goats. They reported that the average property size suggested by RMP for a household with an average size of 5.4 persons do not cover the average living cost of the household.

Our findings reveal that invisible benefits from RMP might be another reason for the low rate of adoption. Landholders' adoption of sustainable management

programs depends on their expectation of the program to develop their goals, which vary from economical objects to social and environmental purposes (Pannell 2006). Before the implementation of the plans, they want to observe the outcomes. The more the outcomes are visible the higher it is likely to be employed by potential adopters. Non-visible outcomes of RMP reduced rural motivation to participate in the plan.

Our findings show that the structure of the RMP is not consistent with local beliefs and values. This includes land distribution, local knowledge and traditional regulations. Findings on landholders' perceptions of rangeland conditions and their attitudes to the RMP indicate that landholders in the study area perceived the RMP incompatible with their own knowledge and experiences. The element of incompatibility with herders' socioeconomic realities was also founded as an important factor in local rejection of vegetation technologies in the Syrian rangelands (Rae et al 2001). Conformity of sustainable programs with social capital becomes more important when the program does not yield tangible short-term benefits. In other words, when the benefits are not clear in short-term, the landholders' decision might be, to some extent, based on their knowledge resulted from a mixture of scientific information, personal experience and cultural influences. Our results indicate that the structure of the RMP could not comprise these two important elements, from the landholders' perspectives.

The results illustrate that, besides the factors concerning the characteristics of the RMP, low adoption of RMP are greatly affected by other elements such as a drought, lack of trust to the government and type of ownership. Results show that most of landholders were concerned about drought and associated problems such as serious losses of livestock due to shortages of forage. They believe that livestock husbandry in this area deals a high risk due to high variation in rainfall. From the landholders' perspective, the RMP has no resolution to rainfall risk. Farmers' attention to the risk management in sustainable practices was also founded by evidence among Australian farmers (Cary 2002). The study shows that many farmers compromise increased profit for risk reduction. According to our finding, the neglect of the government to fulfill its commitments raised local uncertainty to governmental programs. Lack of trust to the governmental system as a barrier to adoption of agricultural programs was reported in other studies. Rae et al (2001) in their study on adoption of shrub technologies in the arid lands of Syria concluded that implementation of these technologies wouldn't succeed with existence of tribes' doubts raised about governmental policy. Another survey of



public grazing permit holders in Nevada conducted by Cornelis van Kooten et al (2005) highlighted the lack of trust between public land agency and ranchers as a significant factor influencing ranchers' disagreement with public agency managers. Furthermore, some studies on RMP proposed that privatization could improve local implementation of the program (Ghandali 2001, Azadi 2005, Arzani 2007, Hedjazi 2007). Our findings reveal that ownership concerns are not similar for all communities. F.e. one can predict that privatization of the summer rangelands might have more impact on local incentives to employ the RMP compared to its impact for the winter rangelands.

## **VI Result 3: Informal institutions in the study area: rules, norms or strategies?**

### **1 Research question**

In this study, informal institutions are particularly referred to the approaches and methods that the rangeland holders use to determine the following issues: Who has the right to use and to manage rangeland resources? How much, when and where should the actual users withdraw resource units?

We start studying the historical context associated with rangeland use strategies with special concentration on the events that are likely to influence the management approaches. By studying the historical context, we search for whether the historical events could provide potential capacities and backgrounds to transport the traditional approaches and strategies associated with rangeland management.

Then we concentrate on whether the informal institutions originate from strategy, norm or rule by following Ostrom's (2005) syntax grammar to distinguish the three volumes of informal institutions (about these terms see chapter B 3.3). The two key format questions were as follows.

1. Do people find any kind of unintended (either moral or social) obligations on what they are doing?
2. Do people find the existence of any form of sanctions for not obeying the locally informal institutions?

To answer the questions we conducted some interviews with local rangeland holders about their reasons for applying the current informal institutions to exploit rangeland resources (details about methodology see chapter C III 4.).

## **2 History of rangeland management in the study area**

### **2.1 Overview**

As the policies and law associated with rangeland management have been applied for all Iranian rangelands, here we consider basically the rules and policies applied for the whole rangelands in Iran, including our study area (Semnan Province). Then, we will extend our review to the literature on the Semnan province.

As it will be described following, over many years until now, the Iranian governments have been regarded the pastoralists as an outmoded people who caused fatal damages to the environment. As the result of that, they imposed some policies and law that destroyed the traditional system. Due to implementing the destructive policies, the traditional institutions have been disappeared over the time, while they have been transformed to the current informal institutions (Baharvand 1983; Shamekhi 1990; Kiyani Haftlang K and Translared by Rajabi A 2003; Badripour, Eskandari et al. 2006; Hedjazi 2007).

The following will describe the different management systems during the past, in the more details. The implementation of the land reform law was a basic change in the public policy related to rangeland management. We will explain management systems and governmental reforms governing the Iranian rangelands in three periods of time, e.g.

- Prior to the enforcement of the land reform law in 1963,
- The first decades of implementation of the land reform (14 years before and 16 years after the Islamic Revolution, 1963-1993) and
- The past 15 years.

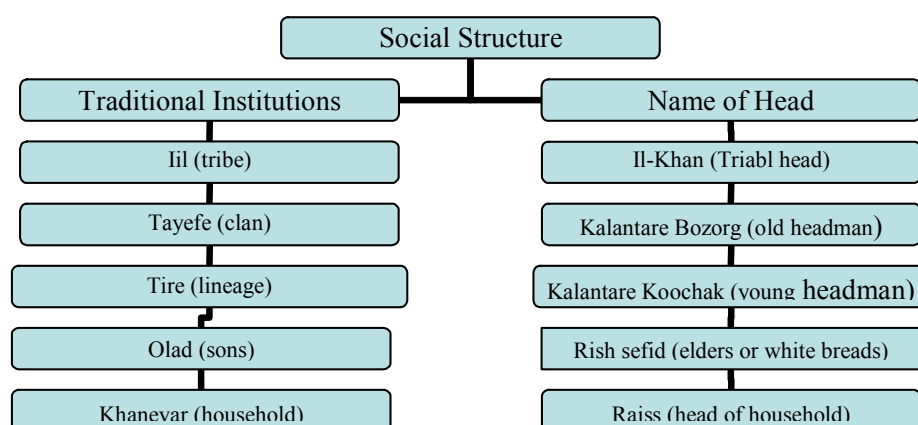
### **2.2 Prior to the enforcement of the law of land reform law 1963**

#### ***Traditional system of rangeland management***

Prior to the enforcement of land reform in 1963, there were two systems of property rights for rangelands including common rangelands used by nomads and private rangelands managed by landlords. Nomads governed most of rangelands in Iran. Nomad society was composed of some tribes (Il) that themselves comprised of Tayefe (clan), Tire (lineage), Olad (sons) and Khanevar (households). The chairmen ruled each branch of the tribe. Khanevar was the smallest unit in nomadic societies. Khanevar was consisted of grand parents,

parents and children who lived together. The oldest male “Rais” in Khanvar was the chairman. All Raises from the same family were known as Olads (sons). The eldest was the chairman of Olads; however most of group decisions were jointly made. A number of families made Tire that was headed by Kalantare Koochak (young headman) who was appointed by Il khan (tribal head) and Kalantare Bozorg (the head of Tayefe). A number of Tirehs was made up Tayefe that was regulated by Kalantare Bozorg (old head man). The head of Tayefe was appointed by Il-khan. A number of

Tayefe formed Il (tribe) that was ruled by Il-Khan who lived a tenet known as Darbar or court. The court was the legal centre of power that served the tribes as a last resort of justification. Sometimes a number of tribes cooperated and formed a confederation that was placed under the leadership of one of Il-khans. The supreme chief of tribes was also known as Il-khan who was appointed by Il-Khans and recognized by the central government. Figure3 illustrates social institutions that influenced community decision-making at that time.



**Figure 12: Power Structure of Traditional Institutions and Related Heads** (adapted from Behzad and Badripour 2007)

The heads made decisions on the place and time of grazing in each branch. Landlords who had cadastral documents possessed another part of rangelands. Some landlords leased their private rangelands to tribesmen for a given period and specific number of livestock. Landlords were concerned about land degradation because they knew that degraded vegetation would lead to reduce rents for the next year. So they periodically monitored their rangelands not to be overgrazed. Most tribal heads were, in fact, landlords who possessed many lands in their areas.

Therefore the two systems were not completely separated from each other (Baharvand 1983).

### ***Governmental campaigns and nomads' reaction***

Before discovery of oil in Iran in 1911 and the resulting income, landlords and nomads, who made up two-thirds of the population, had economical and political power (Shamekhi 1990; Salmasi Dehghan 1995). Relationships between the government and nomads were positive because the taxes they paid on agricultural and livestock products were a major source of the government income. After the beginning of the income from the oil exports and the increased influence of other countries, nomads saw the foreigners as rivals for power. Some government campaigns to improve international trade were opposed by the nomads (for example constructing roads in nomadic territories without their permission). Mainly because of the need for improvement in oil, transportation, and subsequently, nomads' opposition increased. As a result, the government attempted to weaken nomads' power in politically decision making (Mosavinejad 1990). The first campaign against nomads occurred during the reign of Reza Shah in 1920. At that time, a major goal of the state plan was the development of international trade through improved roads. Reza Shah wanted nomads to adopt what he considered to be a modern and civilized way of life. The landlords and heads of tribes resisted the state policy because of their fear of losing their social and political power.

In addition, it was difficult for nomadic people to adapt themselves to a modern society. Therefore; there was resistance by livestock herders to the idea of constructing roads and modernization. Finally, nomadic people had a strong resistance, and Reza Shah's strict insistence on modernization led in 1920s a civil war called Takhte Ghapoo (enforced sedentarization) that lasted for seven years. Reza Shah's fight against nomads were conducted in two ways, armed struggle and inciting ethnic conflicts. Armed struggles took place between the army, tribal heads and landlords. The ethnic conflicts mostly affected poor nomads. During this period, nomadic population in Iran had experienced great suffering with enormous losses in livestock and even reduction in their society due to increased rates of mortality in the peasant communities. Some horrific stories about the methods of disarming and enforcedly settling the tribes have been told. For instance, he sent some landlords and tribal heads into exile in order to destroy the political structure of the pastoral society. In some places, he transferred land

ownership from pastoralists to urban residents (Fisher B. W 2004). The great conflict “Takhte Ghapoo” ended by enforced settlement of nomads in fixed locations with restricted annual migrants (Kiyani Haftlang K and Translated by Rajabi A 2003).

However, some other scholars (Mosavinejad 1990) show that the government stopped trying to settle nomads before Reza Shah’s abdication. According to this reference (Mosavinejad 1990), although the policy of establishing his idea of a modern society had failed in the case of nomads; he did not stop instituting campaigns to change many aspects of the nomadic lifestyle. He encouraged landholders to convert their lands from livestock grazing to agricultural activities in order to sedentarize nomads. In some places, he transferred land ownership from pastoralists to urban residents. He tried even to change practices, such as changing the traditional garment to prevailing fashions or using imported tarpaulins rather than climatically appropriate goat hair tents because he considered tarpaulins to be more modern (Shamekhi 1990). The enforcement of these regulations, the lack of adequate facilities for those nomads who had been sedentarized caused such damage to the economic situation of livestock holders that in some regions most settled herders, even rich ones, suffered poverty (Salmasi Dehghan 1995). Therefore, although some sedentarizations had practically occurred and the policy of modernization accelerated to the process of endemic nomadic life, sedentarized nomads endured a miserable and destitute existence (Cronin 2007). These campaigns reduced livestock production and affected the economy of the country as well.

After Reza Shah was abdicated and his son, Mohammad Reza, came to the power, state pressure on pastoralists decreased for 12 years because of the weakness of the central government. As a result, some landlords returned to their territory and ruled their traditional lands once again. However, after a few years in 1953, nomads and livestock producers encountered other difficulties in their working life. During that year, the king “Mohammad Reza” opened the country’s doors for industrial companies, and as a result many numbers of foreign companies were established in a short period of time. Introducing the industrial goods to the market caused the nomadic situation to get worse. For instance, while the price of industrial goods had been increasing every year, Mohammad Reza imposed a law that farming and livestock products should supply to the market through the government and with stable prices. Therefore the nomads were practically unable to negotiate their products’ prices. This policy caused the situation of nomads and

farmers to become weaker and weaker. Many of them gradually abounded the livestock husbandry and farming activities to daily workers, while they settled in the urban areas (Fisher B. W 2004).

The land reform in 1962 that transferred landlords' control to the government authorities was another policy threatened the nomadic system. This reform was the last strategy intended to restructure the traditional system of rangeland management (Mehrabi, 1995).

## **2.3 Implementation of the land reform 1963 - 1993**

Before ratification of the land reform, in the decade of 1950, the government had begun to issue some rules about rangeland management. The most important<sup>53</sup> of which was issued in 1960, intended to enforce rangeland users to consider technical instructions, from rangeland experts who worked for the government, about balancing livestock with range capacity, grazing season and grazing location.

The law of land reform was issued in 1962, with the regulation of nomads' movement and regulating their rangeland management (Shamekhi 1990; Salmasi Dehghan 1995). Based on the law, all rangelands and forests were allocated to the government and all existing land ownership certificates were revoked. The law excluded grazing fees to the rangeland owners; however, rangeland users were requested by the government to apply for grazing licenses for a short-term<sup>54</sup>. Duties about rangeland management were taken to the two sectors of the Rangeland Office for technical issues, and Forestry Organization for improvement and legal issues.

The enforcement of the land reform harmed the traditional system of rangeland management in terms of both range degradation and nomadic livelihood. It caused many landlords and tribal heads, the main managers of the rangelands, to move to cities and the traditional system to break down to "open access" with overgrazing conflicts. A part of the good rangelands were cultivated and farmlands replaced some permanent-rangelands because it was an easy way for the local people to get

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<sup>53</sup> Law of Forestry and Rangeland "Ain-nameye Ejrai Ghanoon Jangalha & Marate"

<sup>54</sup> As the government intended to emphasize the importance of grazing license, the certificate had to be imposed by head of Agricultural Organization, head of Forestry Organization and governor of the province

land ownership certification. Many rural people used rangelands and there was no incentive for the claimants to cooperate and protect the land (Shamekhi 1990).

In the Semnan province, the pastoralist study (Salmasi Dehghan 1995) indicated that the tribal form of mobility and rules applied by the tribal heads have disappeared, while the system have been changed to the transhumance by small groups or individuals. With consideration that the manner of seasonal movement of pastoralists depended significantly on the climatic circumstances of the area, as well as social characters of the communities, the 65.5 percent of the mobility in the province did individually and the remaining percentage in the form of small groups. The study of Ghandali (2001) presented that in the recent system almost all decisions, including time and place of grazing, were made by household heads either individually or with their cooperation. It can be concluded that the traditional system has eroded over the time, if not completely, at least in its basic structure. With the historical context of the study area in mind, the following presents the results obtained from the semi-structured interviews about the current informal regulations.

### **3 Current informal institutions**

#### **3.1 Data set: Semi-structured interviews**

In this section, we will describe the results of interviews and field observations about the nature of informal institutions that rangeland holders established to use and to manage their common resources. According to the theoretical discussion (see Chapter B), interviews were divided into two parts. The first part was identifying the reasons for which the informal institutions associated with management and use of forage resources have been developed. The second part is related to the punishments and sanctions that the user groups may have in case of not obeying their informal institutions. The interviews were conducted with only 10 respondents, mainly executives, because access was not obtained to all respondents from the second phase. Reasons for rule establishment

During the interviews, it was clarified that sharing benefits and costs within the defined group is the main reason for group agreements about approaches and methods for using and managing the forage resources.

*“Livestock husbandry has very small benefit these days.... Without working together, we won’t have even such small benefits ....*



*“We have no other choice...any of us knows that he will lose if he won’t follow our rules...”*

Additionally, they shared perception that the forage resources in quantity and quality are unevenly distributed, and increased the value of sharing cost and benefit among the defined groups.

*“Today every body knows that holding rangeland and doing livestock husbandry should do in a group....that is because of the rangeland situation... in many lands the quantity and quality of forage resources are not similar across the land ....also this situation varies every year...in rainy years you have good land, while the next year you may have another situation...but who knows perhaps in the future the situation would be changes by modern machines, having a better whether so on so forth”*

During the interview, some people have mentioned that the rules come from their pervious experiences during the years of free riding

*“You know during many years, we understood that cooperation is the only way, we can have benefits...especially at the current situation that the people are not allowed to take as many livestock they want...there is no point for free-riding....Some did it for years, and there was nothing except for having cost for each every body, even the free-rider...”*

Some respondents, however, indicate that the traditions had helped them to decide whether the informal institutions for using and managing the forage resources. However, they mentioned that the rules were useful was another reason for selecting traditional institutions.

*“These rules were the rules that my father used, as well....I suggested them to the people ....some of them knew about them...we now use them, and they work very well “*

### **3.2 Existence of sanctions**

From the interviews it has been cleared that any informal form of physical sanction and punishment did not exist in the study area. The established methods and approaches associated with rangeland management did not supported by any form of punishment and sanction regulations. The respondents described their weakness in executing their established regulations, as the main factor for not being able to set any type of punishment.

*“If some body does not intent to follow our own regulation, we can not do any thing about that except for going to the office....Nobody would do that.....”*

*“We do not have the power of excluding....then the potential offender has more power than us.... he can go to the office, asking for some rights...”*

*“You can never find a group who set some sanctions....sanctions are only in the stories....you can find sanctions in the stories related to tribes”*

*“We can not have any sanctions ...Arranging sanctions make our situation confusing*

*We ourselves have no power to build any sanctions. I feel we can make them, but it does not work if we would not be able to execute them”*

During the interviews, some respondents presented their interest in establishing sanctions and punishments, especially for transforming the regulations to the next generation.

*“Now livestock husbandry has no benefit ...So I do not think that our kids are interested in following our rules and regulations...But if the situation has changed because of weather or coming new machines and technology, they may feel some interest.... for them, I think it is necessary to have some sanctions and punishment systems, especially if they want to follow their fathers’ rules and regulations.”*

### **3.3 Conclusion**

The survey data, interviews and observations all indicate that the main reason for establishing the informal institutions in the Semnan province was group cooperation and self-conscious obtained through previous experiences and the common perception of social benefits and costs. Additionally, the historical affairs in all aspects including culture, social attitudes were not observed to play important role in establishing the informal institutions. For instance, some groups followed their traditional regulations because of finding the rules useful for the group, while they were satisfied from following their traditions.

Nevertheless, it is obvious that cooperation and self-conscious could not be the only reasons for establishing the informal institutions. If we assume that many of our selections and decisions are rooted in the cultural and internal beliefs (McAdams and Rasmusen 2007; Schlüter A & Theesfeld I 2008), we conclude

that the internal preferences and beliefs are still in the play. In addition, even though the two factors of “cooperation” and “self-conscious” were observed as the most important, the degree of their influence is different from one group to another group. Ultimately, while we cannot place the study institutions in the box of the “pure strategy”, we place them somewhere on the line between the “norm” and “strategy”, but very close to “strategy”. Nevertheless, because of the closeness of the informal institutions to the “pure strategy”, we named them as “strategy”, while the concept is different from the “pure strategy”.

## **VII Result 4: Property in-use regimes (PUR)**

### **1 Overview**

To understand whether a government's policy is effective requires not only a clarification of locally applied institutions of management but also the concrete use of forage resources.

Therefore, the overall objective of this section is to classify the practically used informal institutions (e.g. strategies) based on the framework of the New Institutional Economics (NIE) and to identify the driving factors influencing these informal institutions. This analysis is practically conducted by addressing the local institutions of management and use of forage resources that have been implemented for the study area and mainly the study sample. The theoretical framework of this section is based on section B 4.2.

According to the Ostrom definition (Ostrom 2005) of the “rules in use” that indicate the set of rules to which the participants are addressed if they are asked to explain their activities, the term “Property in Use Regime” is used for the property regulations to which the users' groups in Semnan Province are addressed. Four fundamental characteristics of the environment including ‘group characteristics’, village characteristics’, ‘resource characteristics’ and market characteristics are hypothesized to influence the strategies of interaction between the users and the common resources known as ‘action arena’. It is expected that group dissimilarities in any type of the listed elements might cause different incentives and preferences regarding the property institutions. The different incentives themselves might also influence the structure and the diversity of the property institutions.

The implemented strategies are assumed to influence the outcome associated with resource extraction that will be evaluated based on the RMP and GL structures

In the light of this background, in the following section an applied model for the counties Semnan and Dangham is being developed. First we will look to the “action arena” and analyze the “property in use regimes” including the informal strategies used (chapter VII 2.). Then we analyze the influence of the four fundamental characteristics of the environment (‘group characteristics’, village characteristics’, ‘resource characteristics’ and ‘market characteristics’) on the

process of creating PURs (chapter VII 3). In chapter VII 4 all results are then put together to a model of PURs for the study area of Semnan Province.

## **2 „Action Arena“ – PUR’s in Semnan Province**

### **2.1 Classification of the informal strategies**

As described previously, the classification of the informal strategies is based on the “aim” element of the syntax grammar (see chapter B 3.3 The concept of informal institutions). Based on the observed regulations/rules in the study area, the following strategies were classified:

- Property rights define who has rights to use and to manage the rangeland resources. The related strategies with the socio-economic purpose through arranging property rights will be called “*property-in use strategies.*”
- Livestock production is referred to when and where the livestock should be allowed to graze with the ecological purposes through arranging livestock activities. The related strategies will be called “*production-in-use strategies.*”
- Protection is referred to the protection of the rangeland use against outsiders. The related strategies will be called “*exclusion-in-use strategies.*”

### **2.2 Property-in-use Strategies**

The property-in-use strategies explained in the following section include:

- Exclusion and alienation rights,
- Access and withdrawal rights (rangeland division and rotational use of rangeland sites), and
- Management rights (transmission of the right to use the entire rangeland parcel to one member).

#### ***Exclusion and alienation right***

The exclusion right determines who has the right to determine the eligible people for using the resource units as well as to exclude other people from the defined physical property. The alienation right determines the right to transform the other forms of property rights to other people. According to the law of land reform, the Iranian rangelands are nationally considered as the governmental property; while

the rights of using the resources were transferred to the entitled livestock holders<sup>55</sup> through a leasehold contract, as an attachment to the RMP or GL plans. The leasehold contract determines the user group and the amount of forage resources every member is allowed to exploit by assessing the official number of livestock. According to the official authorities and the field observations, the two plans were similar in terms of the process of assessing the members and the boundaries of the rangeland parcels. Nevertheless, they were different in the contract term. The RMP was transferred the using right for a long term of 30 years, while the GL was only for a one year. Since the government regulation of these rights was determined by through a similar process, we will not consider them in the future analysis.

### ***Access and withdrawal rights***

In the study region, although property institutions defined by the government were similar for all studied rangelands in terms of determining rangeland and user group's boundaries, some of the user groups practically established their own rules, which determine who has access to which spot of the rangeland or how the forage resources should be regulated. These rights are defined as access and withdrawal rights.

Some user groups divided their rangelands among either individual or sub-groups (rangeland division). For many cases, the site location allocated to either individuals or sub-groups were traditionally determined, while determination of the boundaries was upon the group agreement. For other parcels, a ballot system was used to divide the parcel of rangeland into either individual or sub-groups. The system was based on writing numbers on pieces of paper. Any member of the group could choose a piece, while he had not known about the written number. The chosen numbers indicate the user's turn to select his desire sites in terms of the location. There was a possibility for those users, who intended to manage the land together, to select the sites beside each other. In this case, the sub-group's turn was assessed by the earliest turn among the members of the sub-group. Determination of the site boundaries was based on the group knowledge about the quality and quantity of rangeland resources. The number of livestock allocated to each member was basically determined by the official lease contract that itself had

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<sup>55</sup> The entitled livestock holders are those who have been traditionally owned livestock and used the certain rangeland for years.

been determined by the traditions and group agreements. Any disagreement on the discussed issues might cause cancellation of rangeland division; even the groups were interested in.

On rangeland or parcels divided into individuals and not sub-groups, some users' groups implemented the regulation of rotational use on a yearly basis (rotational use of rangeland sites). The rotational system was based on the grazing season. Those livestock holders, who used a site with a good condition for a grazing season, were arranged to move to another site with a worse condition for the next grazing season. For the rangeland parcels regulated by this strategy, the yearly scheme for entering the sites was clear for all members. According to the respondents, in any case the users would stay with the planned scheme.

*“If some thing bad happens, it would happen for all sites....in a 0% likelihood that may happen for a certain site, and not for all, we still keep our scheme. Because, we all accept it.....”*

Most of these users mentioned an uneven quantity and quality of forage resource across the entire parcel of rangeland as the major reason for implementation of rotational use. The rule was widely common in mountainous rangelands where various land slopes cause uneven distribution of forage resources. Although boundaries of rangeland parcels were clear within the group, they were flexible from one to another year and depended on the number of livestock owned by the holder.

### ***Management rights***

The management rights are referred to the rights for regulating inner use of forage resources and to conduct improvements in producing the resource units. The transmission of the right to use the entire rangeland parcel to one member was the only management institution observed in the study area. Some user groups transmitted all management rights to one user as the major manager who took all flocks of the group to the rangeland. Although the major manager, some times accompanied with employed shepherds, he was the only person who decided on the grazing management and how to use the forage resources. In many cases, the members trusted the major manager, as they knew each other for many years. In some other cases, members were dealt with another occupation and had no choice other than transferring their rights to the major manager. During the interviews, some respondents referred this rule to a renting rule, while it does not seem to be

the right term. By the renting system, the renting income is fixed for the owners; while here the owner were paid for the selling income, and both costs and benefits of managing resources were shared with the major manager and the absence rangeland holders.

### **2.3 Production in–use strategies**

The production in-use strategies deal with the grazing system that determines how the forage resources should be used in producing the livestock production and converting the forage resources into salable animal products. In fact, these strategies restrict the grazing habits of livestock on the rangeland that determine what type of animals, how, when and where to graze the forage resources. With regard to the formal system, both the GL and the RMP were designed based on continuous grazing. In this form of grazing system, all livestock are placed in a camp for the entire grazing season. The livestock remain in a defined boundary of rangeland for the entire grazing season and are allowed to use the forage resources without being rotated. Additionally, the plans expected the rangeland holders to follow the three main instructions including “the number of livestock,” “the time of grazing” and “the period of grazing”. The livestock managers, who either they or their employees are present on the land during the grazing season, might select different strategies. The selected strategies depended on the managers’ purposes - which could be concentrated on the maximization of annual livestock production or retaining a long-term production potential of the rangeland (matching the nutritional demand of the livestock with the supply of forage), the condition of rangeland as well as how well the animals perform. It is obvious that for the users’ groups with more than one manager, the level of cooperation among the managers also influences many of the implemented strategies. If achieving a group agreement is costly, the group is more likely to leave the livestock uncontrolled on the rangeland during the grazing season. The production-in-use strategies explained below include the characteristics:

- Flock combination.
- Land protection.
- Certain entrance and exit time.
- Hiring a joint shipyard.



By application of the ***‘flock combination’ strategy***, a number of flocks were combined together and made one large flock, which was then divided into sub-flocks, according to the species. For instance any of ewe<sup>56</sup>, cull livestock<sup>57</sup>, ram<sup>58</sup> and hogget<sup>59</sup>, could make a single flock. The entire land was also divided into deferred sites and rotated among various sub-flocks every few days. Allocation of the site to the sub-flocks was based on their nutritional requirements. Good, fresh and non-grazed sites were mostly allocated to the group of hogget and ewe. Based on the “methods of grazing,”<sup>60</sup> this strategy is relatively similar to the grazing systems of “first-and-last grazing” in which groups of animals with different nutritional requirements graze sequentially on the same rangeland. The main reason for implementing this strategy impacts the quality and quantity of forage resources on the milk products.

*“Ewes that have been grazing fresh forages produce more milk with a better quality [...] this is very obvious for mountainous rangelands where forages in slopes are very fresh in the beginning of summer [...] this impact is not so obvious for meat production”.*

According to the survey outcomes of the study area, the mountainous rangelands are more likely to be applied by this strategy. In our sample study, 22 parcels, out of 29 that were partly or entirely located in the mountainous area, implemented the strategy of flock combination.

The ***‘land protection’ strategy*** is to protect some sites to be unused during the grazing season. To apply this strategy, the parcel was divided into some sites (often four sites). During each grazing period, one site remained unused, while the three others were grazed. The unused site would be given a period to recover from grazing and allow plants to regrow. In many cases, some improvement programs such as seeding were applied for the resting sites.

Generally, the rotation is based on successive turns. The forage growth and growing conditions was also important in the selection of the unused sites. In

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<sup>56</sup> Ewe is a young female sheep that is capable of producing lamb

<sup>57</sup> Cull livestock are no longer suitable for raising and selected to sell for meat

<sup>58</sup> Ram is an uncastrated male

<sup>59</sup> Hogget is a young sheep from either six to about nine – 18 months

<sup>60</sup> „The grazing method“ is defined as “a producer or technique of grazing management designed to achieve the specific object(s) Forage and Grassland Terminology Committee (1991). Terminology for Grazing Lands and Grazing Animals, Pocahontas Press.

other words, if the pre-planned program selected a site, while the other site was in a worse condition, the groups were flexible to change the pre-planned spot to the one with the worse condition. The observers believed that it is very rare to observe this situation.

*“During the years, I have never seen this situation you explained [...] but if it happens one day, I think people are flexible to change the pre-planned spot to the bad one [...] we have this strategy to improve the condition of the land...So we are flexible to any change that causes more improvement. “*

It is worth mentioning that for many the RMP cases, similar strategy was advised by the RMP plan. The government even suggested the improvement programs to be conducted by the collaboration with the Technical Office of Rangelands. The application of the strategy depended mainly on the managers. There were many cases that although the strategy was suggested by the RMP, the rangeland managers did not apply it. Here we apply the strategy of “land protection” for the cases that the strategy was applied practically.

The ‘***certain entrance and exit time***’ strategy is a group agreement that all livestock holders take their flocks to the rangeland in a specific time. Sometimes this agreement was set up for only entrance time, only exit time or both grazing times. By this strategy, the rangeland users were expected to enter and exit the rangeland at the agreed times. For many cases, the entrance and exit time was not fixed and depended on the rangeland condition. To assess the rangeland condition, a few months before the grazing season some members of the group visited the rangeland. Then, they specify the grazing times through either formal or informal meetings.

The ***strategy to hire a joint shepherd*** is to reduce the cost of labour. In some cases when livestock holders needed a shepherd because of either having other occupations or having a big flock, they might employ one shepherd or some shepherds with only one contract. One shepherd could usually take care of a flock with the number of 250 to 300 small animals called “normal flock” (Galeye Mamuli). For the livestock holders with small numbers of animals, they might combine their flock and employ one shepherd. The livestock holders might also use one contract to employ some shepherds because using one contract reduces the shepherd cost.

## 2.4 Exclusion in-use strategies

Exclusion regulations are essential parts of managing the rangelands, since the protection of the physical boundaries is often too costly. In fact, these strategies protect the defined boundaries of a given rangeland from outsiders. ‘Exclusion in-use strategies’ include:

- Periodic guarding by landholders.
- Guarding by rangeland holders close to the land.
- Natural guarding (freezing months) and monitoring/guarding arrangements.

The rule ‘*periodic guarding by land holders*’ is to protect the rangeland against outsiders during the non-grazing seasons. The guard who protects the rangeland is one of the members who rotate into taking this responsibility on a regular basis. The monitoring period for one person varies between one week and one month according to the group agreements. At the end of the grazing season, the livestock holders arrange a monitoring program for the non-grazing seasons. Each rangeland holder who had livestock and used the rangeland had to participate in the program.

‘*Guarding by rangeland holders close to the land*’ is in fact a special type of the previous one, while the rule was mainly associated with the rangelands close to where some of the rangeland users either live or work. By this system, some livestock holders, who either had farms or lived close to the rangeland, guarded the rangelands during the farming time. These people were the major executives for monitoring the rangelands against outsiders. In this system, monitoring conducted at a low cost.

Soil freezing of the rangeland as ‘*natural guard arrangement*’ might influence the exclusion strategies, since it can be considered as a natural guard.

The following table illustrates the frequent implementation of the two exclusion strategies based on different number of months that a rangeland was frozen. All rangeland parcels without freezing months have been established by exclusion strategies against outsiders. The percentages of those rangelands, having frequent freezing months, with exclusion strategies seems to be implausible.

Therefore, protection of rangelands against outsiders was one of the major concerns for the users’ groups, and basically they established two guarding arrangements to protect their rangelands against outsiders.

		Freezing months			
		0 months	1-2 months	3 months and more	Total
Guarding by landholders close to the rangeland	Count	28	21	46	95
	% within Freezing months	96,6%	65,6%	68,7%	74,2%
Periodic guarding by landholders	Count	29	28	58	115
	% within R	100,0%	87,5%	86,6%	89,8%
Total	Count	29	32	67	128
	% within Freezing months	100,0%	100,0%	100,0%	100,0%

**Table 23: Exclusion strategies and natural guarding (Freezing months)**

## 2.5 Property Regimes

The most common classification of property regimes are “private property,” “common property,” “state property” and “open access”. In managing common resources, this classification is often meaningful in the formal system where the official rules determine who is allowed to do what. However, in the informal system of many actual situations, property regimes may fall somewhere between the two extremes of pure open access and pure private property regime.

In the following, the four identified regimes for Semnan Province are being described and confined against the common property regime (CPR):

- The unregulated common property regime (UCPR)
- The common property regime with rotational access (CR)
- The common property regime with a unique decision maker (CU)
- The Mini common property regime (Mini)

### *Unregulated common property regime (UCPR)*

In this form of common property regimes, users’ groups had not established any regulation to limit the spatial use of common resources. During the grazing season, the livestock holders can use all the rangeland. In addition, members were allowed to make their own decisions on managing how to withdraw their forage

resources. The established property institutions define a limited number of users for using the common resources, while the property rights among the users remain poorly defined.

Overuse is more likely to occur in a case of an “unlimited open access” allowing the users to extract the common resources at any rate desired. Generally, the UCPR is similar to the “unlimited open access” property regime in the sense that the institutions associated with property rights were poorly defined. Nevertheless, it is different if the UCPR is regulated in terms of other types of institution, such as institutions associated with producing livestock.

### ***Common property regime with rotational access (CR)***

In this form, like the previous one, all livestock holders were allowed to decide on managing their forage resources. To use the rangeland resources, the livestock holders divide the rangeland parcel among themselves, but the boundaries are not fixed for every year. In every grazing season, the sites are been rotated. The one, who had used a rangeland with a worse condition in the last grazing season, was given a rangeland with an adequate condition. This system was similar with the previous one in the way that every individual will finally use all sites. The term “regulated” differentiates between this system and the previous one. The term “regulated” reflects the fact that although the livestock holders will be finally allowed use all site, the regulation of rotating sites limited the extraction of forage resources during every grazing season.

### ***Common property regime with a unique decision maker (CU)***

Only one livestock holder accepts the management of all flocks and forage resources. All livestock holders give their flocks to this major manager. In this system, any livestock holder is allowed to use all rangeland parcels, while only one person is allowed to decide on managing the extraction of forage resources.

This regime or system sounds on the one hand similar to the UCPR in terms of no limitation or regulation on using the forage resources, it is on the other hand also similar to the private property because of having only one person managing the forage resources.

### ***Mini CPR within CPR (Mini)***

In this regime, the livestock holders divide the land among the sub-groups All livestock holders can decide about exploiting the forage resources. The site

boundaries were fixed for any grazing season. The term “Mini CPR within CPR” reflects the fact that a definite sub-group of the initial group used and managed a definite site of the defined rangeland parcel. To put it another way, the system is like a creation of small regimes of common properties within the initial big regime of a common property.

The following table shows briefly how the property regimes in Semnan Province are defined within the common property regimes.

		UCPR	CR	CU	Mini
Limitation on the spatial extraction	Rangeland division	No	Yes	No	No
	Yearly rotation	No	Yes	No	No
Limitation on the group of managers		Members	Members	Only one person	Members

**Table 24: Typology of property regimes in Semnan Province**

In the following, land protection, entrance time, employments of shepyards and flock combinations are summarized as production strategies and related to the four identified property regimes of Semnan Province.

	<i>Land protection</i>	<i>Certain entrance time</i>	<i>Employing a joint shepherd</i>	<i>Flock combination</i>	<i>Total</i>
UCPR	2 (6.2%)	10 (31.2%)	12 (38.7%)	10 (31.2%)	88
CR	21 (60%)	34 (100%)	27 (77%)	25 (73.5%)	65
CU	32 (82.1%)	34 (100%)	33 (84.6%)	39 (100%)	98
Mini UCPR within UCPR	10 (31.2%)	15 (46%)	16 (50%)	14 (45.2%)	88

**Table 25: Implementation of the production strategies among the property regimes**

In most cases, strategies are nested into each other. The creation of some strategies might make the establishment of some other strategies easier. For instance, creating strategies for a Common property regime with a unique decision maker might be easier, than for one with several users.

As the table shows, the CR and CU users had the highest percentage of implementation of the production strategies, while the UCPR and the Mini had the lowest percentages.

In our study area, in order to clear whether the exclusion strategies were linked to property regimes, we obtained the frequencies of the exclusion strategies within the property regimes. The following table presents the frequency and percentage of the two sets of exclusion strategies.

	Periodically protection	Close to land	Both rules
UCPR	29 (90.6%)	24 (75%)	23 (71.91%)
CR	26 (96.3%)	19 (70.4%)	19 (70.4%)
CU	29 (76.3%)	23 (60.5%)	16 (42.1%)
Mini	31 (100%)	29 (93.5%)	29 (93.5%)

**Table 26: Exclusion strategies and the property regimes**

The table shows that implementation of the two sets of strategies were common in all four forms of the property regimes in the study area. The “periodic guard” strategy was implemented more often than the other strategies. Less implementation of the second set of “guarding by close rangeland holders” may be a natural cause of having less people close to the defined rangelands. The CU with only one major manager had the least percentage of implementing these strategies, while the Mini with the highest average number of livestock holders had the highest percentage of implementing the strategies.

### **3 Influential factors on the process of creating PURs**

As discussed in the first section of this chapter, the influential variables that are hypothesized to contribute to the process of creating the PURs are “resource characteristics,” “group characteristics”, “village characteristics” and “market characteristics” The variables that are used in the model are drawn from the two sources:

- “Income sources” and “living location” in the sub-section ‘group characteristics’ are outcomes of the empirical survey.
- All other variables are from literature review.

### 3.1 Resource characteristics

In order to develop an indicator for “resource characteristics,” a factor analysis<sup>61</sup> is conducted on those variables that are theoretically connected to the ecological condition of a rangeland as well as variance of yield (see chapter C III Methodology ‘Property in use-regimes’). Accordingly, the variables included in the analysis are those that relate to geographical situations and climatic condition of Semnan province. Availability of data information for each variable was another limitation to select the variables. Specifically, the variables considered for building an index of “resource characteristics” are “geographical location,” “number of freezing months” and “grazing season.” The variables are hypothesized to influence the quality and quantity of forage resources. It is worth mentioning that some variables might influence selecting the PUR in different ways. For instance, the geographical location influences not only the quality and quantity of forage resources; it is also the forage distribution across the rangeland parcel. The mountainous rangelands were not only rich in quality and quantity, but the resource distribution is uneven across the rangeland. Another example is the grazing season that might influence selecting the PUR by its impact on the livestock dependency, in addition to its impact on the quality and quantity of forage resources. Generally, in Iran and particularly in Semnan, the summer lands were richer than the winter rangelands. In addition, the livestock depends more on the natural resources for their feed needs in the summer than the winter. Therefore, the grazing season might affect selecting the PUR by these two ways.

The rule of thumb is used to determine the number of factors that should be selected. The first three factors were kept as indicators for resource characteristics. The amount of variance accounted for by the factors is 67 percent of the total variance.

The three factors are interpreted as being strongly associated with the grazing seasons.

- The first factor has strongly positive loadings on the winter grazing rangelands as well as plain and hill area and strongly, but negative loadings on the summer grazing rangelands as well as mountainous region, and number of freezing months.



- The second factor has a highly positive loadings on the summer rangelands as well as positively low loadings on the mountainous region, and number of freezing months. This factor has strongly negative loadings on the winter rangeland, spring rangelands and hill regions.
- The third factor has highly positive loadings on the size of rangeland, while positive and low loadings on the spring rangelands and only hill area.

	Factor1	Factor2	Factor3
Size of rangeland	0.488	0.147	0.527
Summer grazing rangelands (official system)	-0.702	0.516	0.368
Winter grazing rangelands (official system)	0.757	-0.073	-0.567
Spring grazing rangelands (official system)	-0.072	-0.728	0.246
Only hill area	-0.136	-0.820	0.205
only plain area	0.542	0.312	0.168
Plain & hill area	0.724	0.448	0.179
Mountainous region	-0.695	0.252	-0.392
number of freezing months	-0.670	0.203	0.025
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

**Table 27: The component (factor) matrix “resource characteristics”**

According to the factor loadings, the three factors are labelled as follows:

- **Factor 1** is a strongly substitute for the winter rangelands (FAC\_W). In addition to the grazing season of winter, this factor represents the geographical location of these rangelands. Factor 1 is an index, which mainly reflexes the **winter rangelands** located in the plain or hill area.
- **Factor 2** is a substitute for the summer rangelands (FAC\_Su). In addition to the grazing season of summer, this factor also represents the

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<sup>61</sup> Principal Component Analysis (Tabachnick and Fidell 2006:23)

geographical location of these rangelands. Factor 2 is an index, which mainly reflects the **summer rangelands** located in the mountainous area.

- **Factor 3** is a substitute for the spring rangelands (FAC\_Sp). In addition to the grazing season of spring, this factor also represents the geographical location of these rangelands. Factor 3 is an index, which mainly reflects the **spring rangelands with a big size** and located in the mountainous area.

In order to present a basic partial impact of rangeland condition on the selection of PUR, we conduct an ANOVA analysis<sup>62</sup> to test whether the PUR are significantly different in terms of rangeland conditions. The result of the ANOVA analysis presents significant differences among the defined PUR in terms of the three factors associated with the rangeland condition (see Table 28)

		Minimum	Maximum	Mean	Std. Deviation	F	Sig.
Winter rangeland in plain area (W)	Mini	-0.94	2.10	0.61	0.95	14.135	0.000
	UCPR	-1.26	1.60	0.13	0.85		
	CU	-1.70	1.29	-0.84	0.83		
	CR	-1.33	1.22	0.14	0.83		
Summer rangeland in mountainous area (Su)	Mini	-2.52	1.38	0.35	0.83	2.514	0.062
	UCPR	-2.60	1.37	0.20	0.91		
	CU	-2.62	0.76	-0.21	1.25		
	CR	-2.60	0.86	-0.22	0.88		
Big spring rangelands in hill area (Sp)	Mini	-0.88	2.46	0.98	0.87	20.032	0.000
	UCPR	-1.35	1.05	0.12	0.81		
	CU	-1.43	0.65	-0.44	0.70		
	CR	-2.35	1.23	-0.48	0.86		

**Table 28: ANOVA test for comparing the factors associated with “resource characteristics” among the PURs**

<sup>62</sup> ANOVA analysis (see Tabachnick and Fidell (2006:19 – synonym “analysis of variance”)

According to the table – providing that all other variables are consistent – the PURs are more likely to be influenced by the general condition of the rangeland.

### 3.2 Group characteristics

The group characteristics will present the socio-demographic status of the users' groups. One part of the variables - including the demographic variables of age, education and the number of livestock - was drawn from the literature. The other part was concluded from the empirical survey.

For each parcel of rangeland, the three following groups of people are distinguished:

- ***Rangeland holders:*** They hold grazing licences for the given parcel of the rangeland. For most of the cases, this is the biggest group in size. Some of the rangeland holders did not own any livestock, and thus they are not included in the following group.
- ***Livestock holders:*** This is a sub-group of the previous one. This group are those who own grazing licences as well as livestock. In fact, they are the actual users of the rangeland units. Some of the members in this group used the rangeland resource, but they did not participate in the grazing management, and thus they are not included in the following group.
- ***Rangeland managers:*** This is a sub-group of the previous one. This group are those that either themselves or their employees went to the rangeland and managed how the livestock should be grazed.

Since the livestock holders made the decisions, the variables associated with the group characteristics were developed to measure the social status of the livestock holders.

Before analyzing the joint impact of these variables on the PUR through the econometric model, we will analyze its mutual impact by comparing the variables across the four types of the PUR. The simple statistical tests “t-test” and “f-test” were used to compare the means and standard divisions of the mentioned variables among the PUR. By comparing the means and standard divisions, we analyze the mutual impact of each variable on the PUR, while other variables are assumed to be constant.

Dependent variable category	Reference	land use systems	Mean Difference	Std. Error	Sig.
average of age (year)	Mini	UCPR	1.13188	1.35915	0.406
		CU	-2.27876	1.29774	<b>0.081*</b>
		CR	0.06665	1.33933	0.960
	UCPR	Mini	-1.13188	1.35915	0.406
		CU	-3.41064*	1.28639	<b>0.009***</b>
		CR	-1.06524	1.32834	0.424
	CU	Mini	2.27876	1.29774	<b>0.081*</b>
		UCPR	3.41064*	1.28639	<b>0.009***</b>
		CR	2.34541	1.26544	<b>0.066*</b>
	CR	Mini	-0.06665	1.33933	0.960
		UCPR	1.06524	1.32834	0.424
		CU	-2.34541	1.26544	<b>0.066*</b>
<b>F-Value= 2.578*</b>					
Average of education (years)	Mini	UCPR	-0.37377	0.45303	0.959
		CU	-0.27834	0.56832	0.997
		CR	-0.54694	0.50413	0.863
	UCPR	Mini	0.37377	0.45303	0.959
		CU	0.09543	0.59625	1.000
		CR	-0.17316	0.53542	1.000
	CU	Mini	0.27834	0.56832	0.997
		UCPR	-0.09543	0.59625	1.000
		CR	-0.26859	0.63595	0.999
	CR	Mini	0.54694	0.50413	0.863
		UCPR	0.17316	0.53542	1.000
		CU	0.26859	0.63595	0.999
<b>F-Value=0.302</b>					
Average of flock (Livestock unit)	Mini	UCPR	63.44155*	18.94960	<b>0.011**</b>
		CU	16.28836	20.62220	0.967
		CR	-35.06557	19.58100	0.395
	UCPR	Mini	-63.44155*	18.94960	<b>0.011**</b>
		CU	-47.15319*	14.03300	<b>0.008***</b>
		CR	-98.50712*	12.45253	<b>0.000***</b>
	CU	Mini	-16.28836	20.62220	0.967
		UCPR	47.15319*	14.03300	<b>0.008***</b>
		CR	-51.35393*	14.87458	<b>0.006***</b>
	CR	Mini	35.06557	19.58100	0.395
		UCPR	98.50712*	12.45253	<b>0.000***</b>
		CU	51.35393*	14.87458	<b>0.006***</b>
<b>F-Value=12.380***</b>					

**Table 29: ANOVA test for comparing the variables of age, education and the flock size among the PURs.**

The Table 29 illustrates that while the years of education were not statistically different among the four PUR, the average age and the average flocks were dramatically different.

In terms of age, the *average ages of the users' groups* who implemented the CU were significantly younger than the other three groups. This indicates that the average age of the user group might be important in selecting the PURs, particularly the CU.

In terms of *flock size*, the table shows that the average size of the flock was significantly smaller in the UCPR than all the three other groups. The average size of the flock for the other groups was statistically similar, except for the CU and CR. The size of the flock in CR was bigger than the CU.

### ***Heterogeneity in the users' groups***

Management of the common resources is difficult when the resource users are heterogeneous in their status. Various purposes can be rooted in heterogeneity within the group status. In addition, heterogeneity may affect the management of the common resources by influencing group cooperation and collective action. Lower heterogeneity is expected to promote cooperation among the users' group. The concept of the heterogeneity variable is mainly described by differences in socio-economic status including wealth, demography and traditional values. In our study area, the traditional values are not expected to play an important role as well as the implemented policies (see chapter B I 3).

Demography, as another origin of the group, can be considered in diverse aspects such as age, education and gender. In our study, we only consider heterogeneity in *age* and *education*. Regarding wealth, the number of livestock was used as a proxy for wealth according to the local perspectives. It is therefore expected that heterogeneity in the number of livestock can explain the heterogeneity in wealth on the users 'groups.

To estimate relative heterogeneity upon the mentioned aspects, we used the coefficient of variation that estimates relative variation in mean. Instead of the total variation, this tool calculates the relative variation in mean that generates the possibility of comparing homogeneity among different groups (Johnson E G. & Qian J. 1999; Kumar A. 2002; Ostrom E. 2005). The coefficient of variation is only used in studies associated with demographic characteristics. For example,

Knight and Pearce (1999) examined how the coefficient of variation concerning age and education influences strategic consensus in a group management. Pelled (1999) investigated the impact of age diversity on social conflicts. The coefficient of variation is the ratio of the standard division to the mean that is<sup>63</sup>:

$$H_{A,E,I} = \frac{|Y_{(A,E,I)i} - Y_{(A,E,I)j}|}{\overline{Y_{(A,E,I)}} n(n-1)}$$

where

- $H_{A,E,I}$  is a heterogeneity indicator of age, education or income
- $Y_{(A,E,I)i}$  is amount of the associated variable for i-th member of the group
- $\overline{Y_{(A,E,I)}}$  is the average amount of the associated variable within the group
- $n$  is the number of livestock holders

If the standard division and mean is equal, the coefficient of variation is 1, and thus the group is completely homogenous concerning the study variable. Groups with  $H > 1$  indicates high variation in the study variable. Groups with  $H < 1$  indicates low variation concerning the study variable.

Small value of mean and small size of the sample causes the coefficient to be sensitive to small changes. In order to avoid a downwardly biased measure of the heterogeneity indicator, the initial heterogeneity was adjusted by the following formula suggested by (Deltas 2003):

$$H_n^{adj} = \frac{n}{n-1} H_n$$

Where

- $H_n^{adj}$  is the adjusted heterogeneity
- $H_n$  is the initial heterogeneity

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<sup>63</sup> Tabachnick and Fidell (2006: 45)

Dependent Variable	PURs		Mean Difference	Std. Error	Sig.
Heterogeneity in age	Mini	UCPR	-0.19884	0.08821	0.156
		CU	-0.12719	0.09988	0.752
		CR	0.01851	0.08514	1.000
	UCPR	Mini	0.19884	0.08821	0.156
		CU	0.07165	0.10245	0.982
		CR	0.21735	0.08814	<b>0.094*</b>
	CU	Mini	0.12719	0.09988	0.752
		UCPR	-0.07165	0.10245	0.982
		CR	0.14570	0.09981	0.620
	CR	Mini	-0.01851	0.08514	1.000
		UCPR	-0.21735	0.08814	<b>0.094*</b>
		CU	-0.14570	0.09981	0.620
<b>F-Value= 2.240*</b>					
Heterogeneity in education	Mini	UCPR	0.11067	0.17525	0.989
		CU	0.34675	0.16532	0.217
		CR	0.12901	0.20313	0.989
	UCPR	Mini	-0.11067	0.17525	0.989
		CU	0.23608	0.16106	0.616
		CR	0.01834	0.19967	1.000
	CU	Mini	-0.34675	0.16532	0.217
		UCPR	-0.23608	0.16106	0.616
		CR	-0.21774	0.19102	0.834
	CR	Mini	-0.12901	0.20313	0.989
		UCPR	-0.01834	0.19967	1.000
		CU	0.21774	0.19102	0.834
<b>F-Value= 1.337</b>					
Heterogeneity in flock size	Mini	UCPR	-0.95878*	0.14436	<b>0.000***</b>
		CU	-0.24058	0.15514	0.557
		CR	0.11067	0.11889	0.929
	UCPR	Mini	0.95878*	0.14436	<b>0.000***</b>
		CU	0.71820*	0.18913	<b>0.002***</b>
		CR	1.06944*	0.16074	<b>0.000***</b>
	CU	Mini	0.24058	0.15514	0.557
		UCPR	-0.71820*	0.18913	<b>0.002***</b>
		CR	0.35125	0.17049	0.234
	CR	Mini	-0.11067	0.11889	0.929
		UCPR	-1.06944*	0.16074	<b>0.000***</b>
		CU	-0.35125	0.17049	0.234
<b>F-Value= 16.389***</b>					
* . The mean difference is significant at the 0.1 level; ** . The mean difference is significant at the 0.05 level., ***. The mean difference is significant at the 0.01 level.					

**Table 30: ANOVA test for comparing the variables associated with heterogeneities in age, education and the flock size among the PURs**

The Table 30 represents the analysis of different aspects of heterogeneity within the users' groups and between the land use systems.

The result indicates that heterogeneities in education did not differ in the four PUR, and thus this aspect of heterogeneity might have no influence on the selection of the PUR. Heterogeneity in the flock size as proxy for wealth, on the other hand, is presented to be significantly higher in the UCPR than the three other groups. By the simple comparisons of the various heterogeneities among the PUR, it can be concluded that heterogeneity in wealth may contribute to the selection of the UCPR against the three other groups

The two variables "*income sources*" and "*living location*," which are explained in the following section are results of the empirical survey. According to the field survey, livestock holders have usually earned their income from different sources of occupations. The main source of income for the livestock holders and how important is livestock products are hypothesized to affect selecting the PUR. This factor of "sources of income" will be explained by the three variables. The first variable is the percentage of livestock holders within the users' group, whose main occupation was livestock husbandry. The second variable is the percentage of livestock holders within the group, whose main income were agricultural activities. The third variable is the percentage of livestock holders within the group, whose main source of income was other occupations.

The results of partial impact of these three variables on the PURs are presented in the following table. The results show that the users' groups associated with the four PUR was significantly different in terms of generally main source of income. According to the table, in CR compared to the other groups, many of livestock holders did livestock husbandry and agricultural activities as their main source of income. While in the CU compared to the other groups, averagely a high percent of livestock holders did occupations other than agriculture and livestock husbandry. Comparison between the UCPR and Mini, the table shows that in Mini a higher percentage of livestock holders did livestock husbandry as their main occupation.



	Property Use regimes	in	Mean Difference	Std. Error	Sig.	land use systems
Livestock husbandry as the main occupation (percent of livestock holders)	Mini	UCPR	21.023 <sup>*</sup>	3.368	0.000	***
		CU	,32,858 <sup>*</sup>	3.213	0.000	***
		CR	-11.508 <sup>*</sup>	3.318	0.001	***
	UCPR	Mini	-21.023 <sup>*</sup>	3.368	0.000	***
		CU	11.835 <sup>*</sup>	3.213	0.000	***
		CR	-32.532 <sup>*</sup>	3.318	0.000	***
	CU	Mini	-32.858 <sup>*</sup>	3.213	0.000	***
		UCPR	-11.835 <sup>*</sup>	3.213	0.000	***
		CR	-44.367 <sup>*</sup>	3.161	0.000	***
	CR	Mini	11.508 <sup>*</sup>	3.318	0.001	***
		UCPR	32.532 <sup>*</sup>	3.318	0.000	***
		CU	44.367 <sup>*</sup>	3.161	0.000	***
F-Value=78.85***						
Agricultural activity as the main occupation (percent of livestock holders)	Mini	UCPR	0.623	3.371	0.854	
		CU	26.079 <sup>*</sup>	3.216	0.000	***
		CR	-28.718 <sup>*</sup>	3.321	0.000	***
	UCPR	Mini	-0.623	3.371	0.854	
		CU	25.456 <sup>*</sup>	3.216	0.000	***
		CR	-29.341 <sup>*</sup>	3.321	0.000	***
	CU	Mini	-26.079 <sup>*</sup>	3.216	0.000	***
		UCPR	-25.456 <sup>*</sup>	3.216	0.000	***
		CR	-54.797 <sup>*</sup>	,3,164	0.000	***
	CR	Mini	28.718 <sup>*</sup>	3.321	0.000	***
		UCPR	29.341 <sup>*</sup>	3.321	0.000	***
		CU	54.797 <sup>*</sup>	3.164	0.000	***
F-Value=100.021***						
Other occupations	Mini	UCPR	-25.530 <sup>*</sup>	3.337	0.000	***
		CU	-30.348 <sup>*</sup>	3.183	0.000	***
		CR	11.885 <sup>*</sup>	3.287	0.000	***
	UCPR	Mini	25.530 <sup>*</sup>	3.337	0.000	***

		CU	-48.18	3.183	0.133
		CR	37.415*	3.287	<b>0.000***</b>
	CU	Mini	30.348*	3.183	<b>0.000***</b>
		UCPR	4.818	3.183	0.133
		CR	42.233*	3.131	<b>0.000***</b>
	CR	Mini	-11.885*	3.287	<b>0.000***</b>
		UCPR	-37.415*	3.287	<b>0.000***</b>
		CU	-42.233*	3.131	<b>0.000***</b>
	<b>F-Value=80.424***</b>				

**Table 31: The ANOVA test for comparing the variable of “sources of income” in the PURs**

According to the field survey, it is hypothesised that the location where the rangeland users lived, due to the ease of their accessibility to rangeland resources, had a significant contribution to the selection of the PUR. According to the field observations, the willingness to involvement in use and management of forage resources were different for *city users* and *village users*. Those who live in a village are likely to use the rangeland, even for a small number of livestock, even with very bad conditions of the rangeland. The variables of the “percentage of livestock holders who lived in a city” and the “percentage of livestock holders who lived in a village” are used to estimate the living location.

The following table illustrates the differences among the PURs in terms of the “percentage of the users’ group who live in a village or a city”. The table illustrates that in CU compared to the other groups, a high percentage of livestock holders lived in the city. The three other groups were not significantly different in the percentages of livestock holders who lived in the city.

The willingness of rangeland holders, who live in cities, to participate in management and use of forage resources were more influenced by their occupations and their expected incomes from the livestock husbandry. Since livestock husbandry was often considered to have a low expected income, those city users with high income were not as interested as those with low income in use and management of forage resources.

	PUR		Mean Difference	Std. Error	Sig.
LSD	Mini	UCPR	-4.976	0.06170	0.421
		CU	-23.302*	0.05887	<b>0.000</b>
		CR	3.485	0.06036	0.565
	UCPR	Mini	4.976	0.06170	0.421
		CU	-18.325*	0.05887	<b>0.002</b>
		CR	8.461	0.06036	0.163
	CU	Mini	23.302*	0.05887	<b>0.000</b>
		UCPR	18.325*	0.05887	<b>0.002</b>
		CR	26.786*	0.05746	<b>0.000</b>
	CR	Mini	-3.485	0.06036	0.565
		UCPR	-8.461	0.06036	0.163
		CU	-26.786*	0.05746	<b>0.000</b>

\*. The mean difference is significant at the 0.05 level.

**Table 32: Percent of the users groups living in a city and PURs**

Furthermore, the two variables of *occupations* and *accommodations* are supposed to have a very strongly intra-linkages. Those who do businesses other than livestock and agricultural activities are more likely to live in cities, while the major livestock holders and farmers are to live in villages.

By using all intra-linked variables, we developed a typology to represent a clear diversity of the “group characteristics” in terms of their location and occupation. The Table 33 presents the typology outcome of these variables.

In order to obtain a basic understanding of the impact of characteristics of users’ groups on the implemented PUR, we did cross-tabulation of the three classes with the PUR. The following table presents each class of the users’ group associated with the number (and percentage) of the PUR implemented by them.

		City users with other occupation (City 1)	City users with occupations of agriculture and livestock (City2)	Majority live in a village (Village)
Majority of the users' group live in a city	Majority of the users' group have the main job other than agriculture and livestock husbandry	yes	no	no
	Majority of the users' group have the main job of agriculture and livestock husbandry	no	yes	no
Majority of the users' group live in a village		no	no	yes

**Table 33: Typology of the group characteristics based on the sources of income and the living places**

	UCPR	CR	CU	Mini	Total
<b>Citygroup 1</b>	7	0	<b>20</b>	0	27
	25.9%	0%	<b>74%</b>	0%	
<b>Citygroup 2</b>	3	5	2	<b>7</b>	17
	17.6%	29.4%	11.8%	<b>41.2%</b>	
<b>village</b>	22	29	13	23	87
	25.3%	33.3%	14.9%	26.4%	

**Table 34: Comparison of the "Group Characteristics" by the PUR**

The Table 34 shows that the “Citygroup 1” intend to implement the CU system. The “Citygroup 2” intend on implementing the Mini, while the “village” was rather intend on implementation of either Mini or CR.

### 3.3 Village characteristics

In the first part of the analysis we focus on the fragmentation in the study villages. According to our discussion in the theoretical part, social norms may influence decisions on the PUR. Considerations to the element “village characteristics” hypothesize whether users’ groups have been impacted by what people around them do and think. Since many of the village characters are not directly

measurable, in our study we consider the “diverse patterns of the PUR” at the village level as a latent variable. In other words, we assume that village differences in terms of social norms associated with the PUR presents in the latent variable of village diversity what we will later call the “type of village.” The argument stands at the point that if social norms have influenced the implementation of the PUR; the impact has to show up in a diversity in the PUR at the village level.

To distinguish different patterns of PUR at the village level, we use the method of typology in a conceptual form. The approach is conceptual because we initially selected the basic variables PUR on which the typology will be built.

Table 35 shows the number of rangeland parcels for each village in the research area related to the four identified property in use regimes.

To do the typology, we initially started the PUR as the basic variable for classifying the study villages. Since this variable was not able to demonstrate various patterns in the study villages, we used “rangeland division” as the other possible variable associated with the PUR. As the table shows, the study villages are clearly fragmented corresponding to the “rangeland division”. Accordingly, we identified two types of villages for the study area:

- “Villages with mixed PURs” which are the villages where both forms of rangeland division appear (Mini & CR), and
- “villages with no division” (CU & UCPR).<sup>64</sup>

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<sup>64</sup> Therefore, the coding for the model was based on the following classification: coding ‘1’ for villages with mixed PURs and coding ‘0’ for villages with unique system (with division or without division).

Name of the village	Number of rangeland parcels with Mini CPR	Number of rangeland parcels with CR	Number of rangeland parcels with UCPR	Number of rangeland parcels with CU	Total number of rangeland parcels
	Rangeland division		Rangeland non-division		
2Zahir	5	3	3	0	11
Chashme Olya	0	1	3	8	12
Foolad mahaleh	0	3	9	2	14
Hassan Abad	4	0	0	1	5
Lasjerd	1	8	0	1	10
Parvar	0	1	4	11	16
Tooyedarvar	3	0	0	0	3
Arvane	3	0	2	1	6
Deh Sofiyan	0	1	1	0	2
Ghooshe	1	3	2	0	6
Kelate	2	3	2	0	7
2zahire bala	2	2	2	1	6
hahshirin	0	1	0	0	1
Momenabad	0	2	0	0	2
Rashm	1	0	0	0	1
Seydabad	1	0	0	0	1
Yazdanabad	2	0	0	0	2
<u>Ahvanoo</u>	2	1	0	0	3
<u>Astane</u>	2	2	0	0	4
<u>Inj</u>	1	1	0	0	2
<u>Jovein</u>	1	1	0	0	2
<u>Tazare</u>	1	2	0	0	3
Chashm	0	0	2	9	11
Chashtkhooran	0	0	1	0	1
Lord	0	0	0	3	3
Molade	0	0	1	1	2
Paghale	0	0	0	1	1

**Table 35:** The study villages with the number and frequencies of the implemented PUR.

In the following, we present the general characteristics of rangeland parcels for the two groups of villages. The table 36 presents that the classified villages are

also fragmented in terms of number and the size of parcels. Rangelands occupy a larger area in the “mixed villages” than the “villages with only division or non-division.” Accordingly, the numbers of parcel is more in the “mixed villages” than the other.

	Number of villages	Average number of parcels	Average size of rangeland in the village (hectares)	Average size of a rangeland parcel (hectares)
Mixed villages	11	8.73	18,672.9090	2,437.767
either “division” or “no division”	16	2.624	8,498.124	3,950.182

**Table 36: General characteristics of rangeland parcels for the two groups of villages**

### **3.4 Market characteristics: Livestock market**

Market condition is often cited as an important factor, influencing land use systems, including property regimes (Swallow& Bromley 1992; Kamara 2000). The influence of market is often considered through the exogenous variables of “access to markets” and “input/output prices” (North 1990; Kamara 2000; Kamara et al. 2004). Differentiation of these two variables can cause different preferences for the choice of economic institutions (North 1990; Swallow& Bromley 1992).

In the study area, like many parts of Iran, prices do not expect to create variation in local strategies developed by the rangeland holders, since the government attempts at stabilizing the market. The input and output prices associated with most food items, including livestock husbandry, have been strictly controlled by the government due to the high rate of inflation (about 15.8 % for consumer prices in 2007 - Statistical Centre of Iran 2007). The policy of controlling food prices has been started from the beginning years after the Islamic revolution when the rapid population growth, in addition to the problem of the high inflation remained from the pervious regime, intended to raise the agricultural prices (Mojtahed&Esfahani 1989). During the years, the agricultural sector as the major source of the food supply attempted at stabilizing the prices of the main food items, in the presence of the high inflation through applying various macro policies. For instance, on the consumer side, the government imposed a heavy subsidization on the consumption of the main food items. This policy attempted to

keep the agricultural prices low without having influence on their production. Therefore, the price of agricultural production has been remaining relatively stable, while the price of other products has been increasing due to the inflation.

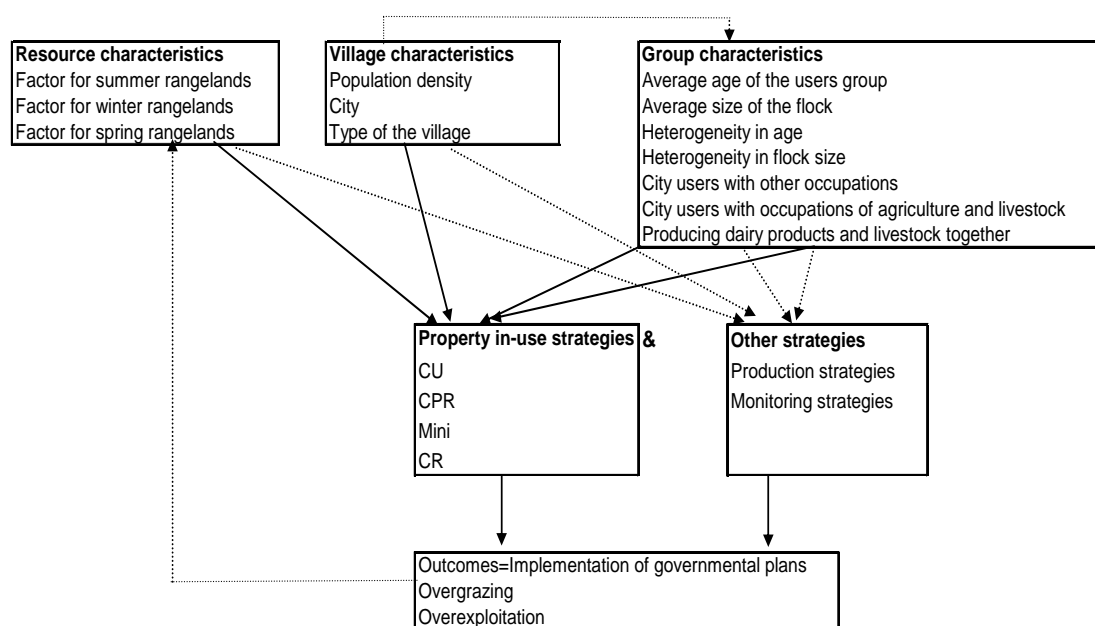
On the production side, the government attempted to reduce the product costs by subsidizing the inputs, such as fertilizers, seeds, and hand feeds for the livestock. Imports of food products were another policy to remain prices stable. In specific times when the controlled prices influence the agricultural production, the government raises the administrated prices for the producers (and not for the consumers), in order to prompt production incentives (Najafi 2000). Ultimately, the government's policies of controlling agricultural prices causes market prices to be relatively similar from one place to another, the real impact of this policy require more studies on the performance of other economic firms. This study concentrates mainly on the impact of market prices (as an explanatory factor) on the choice of property strategies implemented by the local group, therefore the real impact and the influential process will not be studied.

Besides the described background, a part of the study survey in the first round was focused on the market situation, in particular market location and prices (see Appendix 1 Question14). The survey results revealed that all rangeland holders in the study area produce meat as the major product, while may also produce milk and dairy products during the summer. While meat is the main selling product of rangeland, the rangeland holders sell it in the form of life animal. The slaughterhouses under the supervision of AJO (Agricultural Jihad Organization) was the main place where the livestock holders sell their life animal for meat. However, the producers are free to sell their products to private traders. It was rare to find private dealers, since the products should be finally purchased by slaughterhouses because of controlling the livestock healthy. There were 10 slaughterhouses in the Semnan province, 5 of which located in Semnan county and one in Damghan county. The slaughterhouse provided the livestock owners, who lived close to the centre (less than 200 kilometers) with free transportation services. Since all study villages were in the area where they could use the transportation services, the market distance was not observed as an important factor in diverse decisions on livestock management. Ultimately, since all study area were in the similar situation in terms of the two important factors of "input/output prices" and "market distance", the market will not be included in the final model.



## 4 Identifying key variables for the conceptual model of Property in-Use Regimes (PUR)

The conceptual model consists of three different scopes of characteristics designed at describing the process of establishing the informal strategies. The variables included in each scope were drawn from either the theoretical background or the empirical survey of the study area (see Figure 13).



**Figure 13: Conceptual model for the study area of Semnan Province**

In terms of the “group characteristics,” it is hypothesized that the class “city users with other occupations” contribute to the selection of CU because many of the users’ group were busy with occupations other than agriculture and livestock husbandry. These absent holders are hypothesized to transfer their rights to manage their resources to other rangeland holders. This reduces the number of the major managers, even to one person (CU). Instead, the class of “village users” is hypothesised to contribute to the selection the CR, as a system that requires the presence of the majority to be implemented. The condition is more likely to be happened when the majority live in a village.

With regard to “resource characteristics,” it is hypothesized that the class of “summer rangeland in the mountain area” contributes to the selection of the CR. Across mountainous rangelands; the forage resources are more likely to be

unevenly distributed. The rotational arrangement is hypothesised to contribute to equally spread of an uneven distributed resource among the rangeland holders. For other factors associated with “resource characteristics,” it is hypothesized that they influence the LUS, but the direction is unclear.

With regard to “village characteristics,” the population density is hypothesized to contribute to selection of the LUS with rangeland division, e.g. the Mini and the CR. Population density influences theoretically resource scarcity. The higher the population density the more demand for livestock products are, and the more likely resource scarcity appears.

The reduced form of the model that is a simpler form of the full model is presented below. In the reduced form, instead of using all variables, we use the three main groups of characteristics, any of which is a matrix of included variables. The hypothesis that described so far can be summarized into the following equation:

$$PUR = f(G, V, R)$$

where

- $PUR$  is Rangeland-in-Use Regime  $\left\{ \begin{array}{l} 0 \text{ if the reference category} \\ 1 \text{ if the comparative category} \end{array} \right.$
- $G$  is a vector of all defined characteristics associated with the study users' group including:

-Average age of the users' group

-Average size of the flock in the users' group (AG)

-Heterogeneity in age (HA)

-Heterogeneity in flock size (HF)

-City users with other occupations  $\left\{ \begin{array}{l} 0 \text{ if the users' group doesn't belong to} \\ 1 \text{ if the users group belongs to this} \end{array} \right.$

this category

(city1)

category

to this category

-City users with occupations  
(of agriculture and livestock (city2))

category

0 if the users' group doesn't belong  
1 if the users group belongs to this

belong to this category

-Majority live in a village  
(Village)

category

0 if the users' group doesn't  
1 if the users group belongs to this

-Percent of the users' group, producing dairy and livestock together (PD)

- $V$  = A vector of all defined characteristics associated with the study villages including:

- Population density per one hectare (Pop)

- City

(C)

1 if it is located in Semnan city  
0 if it is located in Damghan city

- Type of the village

(V\_Mix)

1 if it is "villages with mixed PUR"  
0 if it is not

- $R$  = Resource characteristics; scores estimated by the factor analysis including

- Factor for spring rangelands (Fac\_SP)
- Factor for summer rangelands (Fac\_SU)
- Factor for winter rangelands (Fac\_W)

A multinomial logit regression<sup>65</sup> is used to estimate the probability for the users 'group to select a PUR according to the explanatory variables. The model presented here consists of the six equations. For each equation, a specific the PUR was selected as a reference category to which the other PUR will compare the coefficients that will be presented by the following table. The coefficients are an odd ratio between the reference category and the response category. The odd ratios are the relative measure of the relation between two variables, assessing the probability of a certain outcome occurring, compare to the alternative, due to changes in a certain amount of a given variable. In our study case, the odd variables are calculated by the following formula:

$$\frac{P_1 / (1 - P_1)}{P_2 / (1 - P_2)}$$

where

- $P_1$  is the probability of occurring the reference category, and
- $P_2$  is the probability of occurring the compared category.

Coefficients with negative sign present reduction in the probability of the response category with respect to the reference category.

Before going through the results, it is worth mentioning that the coefficient themselves should not be used for interpretation. Nevertheless, the important parts, using for interpretation, are the significance of the coefficients as well as the impact directions (signs the coefficients). According to the obtained results (see Tables 37-40) the explanatory factors can be categorized into three groups of variables:

- Key variables.
- Semi-important variables.
- Non-important variables.

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<sup>65</sup> Borooah (2002)

The key variables are those that, according to the equation results, contributed to the creation of all four types of PURs. The semi-important variables are those that, according to the equation results, contributed to creation some of the PURs. And the non-important variables are those that did not have any contribution to the creation of any form of PURs.

Key variables	Semi-important variables	Non-important variables
<b>Group characteristics</b>		
Flock heterogeneity	<ul style="list-style-type: none"> <li>• Average age of the group</li> <li>• Dairy product for selling</li> <li>• City users with agricultural activities (City2)</li> </ul>	<ul style="list-style-type: none"> <li>• City users with other activities (City1)</li> <li>• Age heterogeneity</li> </ul>
<b>Village characteristics</b>		
Population density	villages with mixed system	City
<b>Resource characteristics</b>		
Spring(&Summer) rangelands		Winter rangelands

**Table 37: Overview of identified variables**

### ***Key variables***

In the following section, we present the first group of variables, the key variables. The key variables are those that are significant in all six equations. The following were determined as the key variables by the estimated equation:

- “Population density”-belong to village characteristics.
- “Heterogeneity in flock” - belong to users’ group characteristics.
- “Summer rangelands” – belong to resource characteristics.

The estimated equation assessed the “*population density*” as the most important variable, among the variables associated with the village characteristics, in creating the type of PUR. The population density influenced the three regimes of UCPR, Mini and CU (see Tables 38-41), the higher the population density of the village where the rangeland parcel is located the more likely the users group implement the CU than UCPR or Mini, while in the same situation, they are more likely to select UCPR than Mini. Furthermore, in the high population density of the village, users’ group prefer the CR than Mini. Therefore, in the very highly-

populated villages, the CU is the most likely of PUR to be applied; while in the very low populated villages the Mini is the most likely of PUR.

The estimated equation determined the ***“Heterogeneity in flock size”*** as the key variable, among the variables associated with the group characteristics, in creating the PUR (see Tables 37-40). According to the model, the higher the heterogeneity in the size of the flock, the more likely the users’ group select the UCPR than any other PURs. Additionally, increase in the heterogeneity in the flock size causes the users’ group to prefer the Mini than the CR.

The ***“factor for spring rangelands”*** -a long with the summer rangelands played as the key variables, among the variables associated with the resource characteristics, in selecting the PURs (see Tables 37-40) it seems that the spring had more impact in selecting the PUR. According to the results, the spring rangelands are more likely to be managed by UCPR than CR or CU. Mini compared to the UCPR, is more likely to be implemented for the summer and spring rangelands than UCPR.

### ***Semi-important variables***

In the following section, we present the second group of variables, the semi-important variables. The semi-important variables are those that are significant in some equations, but not all. In fact, they contribute to the selection of only some PURs. Among the variables associated with the group characteristics, the ***“average age of the users group”*** contributed to the implementation of the CR and the CU. To put it another way, the older the average age of the users group is the more likely they select the CR than the UCPR or Mini. Additionally, between the UCPR and the CU, the users groups with older average of age are more likely to apply the CU than the UCPR.

The ***“average size of the flock”*** is another variable of group characteristics that contributed the creation of the CR. Those who have a very big size of flock are more likely to implement CR than UCPR, Mini or CU. The “dairy product for selling” is another variable of the users’ group characteristics that influenced the creation of CR. Those who produce dairy products for selling are most likely to implement the CR than the UCPR or the CU. “City2” is the other variable of the group characteristics that contributed to creation of the CU and the CR. Those rangeland parcels whose majority live in cities with the major occupation of agriculture and livestock are more likely to implement the CR and the CU than the Mini. The mixed village –associated with the village characteristics- is another

important variable that contributed to the creation of the CR than the Mini. In other words, in the villages where the mixed systems of PURs were observed, the CR, compared to Mini, is more likely to be implemented.

### ***Non-important variables***

The non-important variables are those that are not significant in any of the equations. The variables group city1, hetero-age and winter have not observed any influence on the systems, and thus, they are recognized as the non-important variables in the study region.

In the following, results will be explained based on the PUR.

### ***Common property regime with rotational access (CR)***

According to the result, this system is more likely to be selected by the old users groups with the big size of livestock. Majority of the users' groups, who applied the CR, lived in villages, and not cities. The CR is a common system for summer rangelands located in the mountainous area. In addition to livestock, dairy products are the other production for sell. In fact, dairy product is the main production among the CR users.

### ***Mini CPR within CPR (Mini)***

According to the results, the Mini is the most likely PUR to be selected for summer and spring rangelands. Especially, for summer rangelands in the villages with a high population density per a hectare, it is more likely to observe the Mini. Those users' groups who live in city and do agricultural and livestock activities as the main occupation are less likely to implement the Mini.

### ***Unregulated common property regime (UCPR)***

The UCPR is the most likely PUR to be selected for winter rangelands. The flocks of livestock taken to a UCPR rangeland are more likely to be heterogeneous in their size. The statistical results present a significant difference between the UCPR and the CU, while such difference was not observed between the UCPR and the two other PURs. An increase in population density is more likely to transform Mini to the UCPR.

***Common property regime with a unique decision maker (CU)***

The CU is more likely to be selected for the summer rangelands. Additionally, we find that CU is very common in the villages with a high population density. For a summer rangeland parcel located in a populated village, the users' group is more likely to select the CU than the CR.



	UCPR VS.					
	Mini		CU		CR	
	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)
Intercept	-10.583		<b>-8.482</b>		<b>-45.961</b>	
<b>G: Group characteristics</b>						
Average age of the users' group (P)	-0.070	0.933	<b>0.162</b>	1.176	<b>0.36</b>	1.434
Average size of the flock in the users' group (P)	0.004	1.004	0.01	1.01	<b>0.043</b>	1.044
Heterogeneity in age (P)	-1.064	0.345	-0.837	0.433	-2.451	0.086
Heterogeneity in flock size (P)	<b>-2.811</b>	0.060	<b>-1.766</b>	0.171	<b>-2.749</b>	0.064
Majority live in city with activities other than agriculture and livestock (P) <sup>+</sup>	20.104	0.000	-1.177	0.308	24.439	0
Majority live in city with agriculture or livestock activities (P) <sup>+</sup>	-2.583	0.076	1.049	2.855	0.789	2.201
Percent of the users' group, producing dairy and livestock together (P)	4.569	96.459	0.38	1.462	<b>9.264</b>	10550
<b>V: Village characteristics</b>						
Name of city (P) <sup>+</sup>	2.113	8.271	-1.236	0.291	2.454	11.64
type of the village (V) <sup>+</sup>	1.291	3.636	0.184	1.202	-2.531	
Population density (V)	<b>-71.736</b>	0.000	<b>16.945</b>	0	-26.724	0
<b>R: Resource characteristics</b>						
Summer land in mountain (P)	<b>1.689</b>	5.412	-0.569	0.566	0.213	1.238
Winter lands in plain (P)	0.000	1	0.001	1.001	-0.917	0.4
Spring land in corridor (P)	<b>2.225</b>	9.256	<b>-2.265</b>	0.104	<b>-3.412</b>	0.033
Prob>Chi <sup>2</sup>						0.000
Cox and Snell						0.858
Nagelkerke						0.916
McFadden						0.706

**Table 38: Estimation result for the probability to implement the UCPR +Dummy variables (P) Variable measured at the level of rangeland parcel (V) Variable measured at the level of village Coefficients in bold are significant at 10%**

	CR vs.					
	Mini		UCPR		CU	
	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)
Intercept	<b>35.375</b>		45.961		34.479	
<b>G: Group characteristics</b>						
Average age of the users' group (P)	<b>-0.43</b>	0.651	<b>-0.36</b>	0.697	-0.198	0.82
Average size of the flock in the user' group(P)	<b>-0.039</b>	0.962	<b>-0.043</b>	0.958	<b>-0.033</b>	0.967
Heterogeneity in age(P)	1.384	4.004	2.451	11.597	1.614	5.021
Heterogeneity in flock size(P)	-0.062	0.94	<b>2.749</b>	15.629	0.983	2.672
Majority live in city with activities other than agriculture and livestock(P)+	-4.335	0.013	-24.439	0	-25.616	0
Majority live in city with agriculture or livestock activities(P)+	<b>-3.372</b>	0.034	-0.789	0	0.26	1.297
Percent of the users' group, producing dairy and livestock together(P)	-4.695	0.009	<b>-9.264</b>	0	<b>-8.884</b>	0
<b>V: Village characteristics</b>						
Name of city (P)+	-0.342	0.711	-2.454	0.086	<b>-3.69</b>	0.025
type of the village (V)+	<b>3.822</b>	45.683	2.531	12.563	2,715	15,107
Population density (V)	<b>-45.011</b>	0.000	26.724	0	<b>43.67</b>	0
<b>R: Resource characteristics</b>						
Summer land in mountain (P)	<b>1.475</b>	4.372	-0.213	0.808	-0.782	0.457
Winter lands in plain (P)	0.918	2.504	0.917	2.502	0.918	2.504
Spring land in corridor (P)	<b>5.638</b>	280.84	<b>3.412</b>	30.34	1.147	3.15
Prob>Chi²						0.000
Cox and Snell						0.858
Nagelkerke						0.916
McFadden						0.706

**Table 39: Estimation result for the probability to implement the CR, +Dummy variables;**  
**(P) Variable measured at the level of rangeland parcel (V) Variable measured at the level of village Coefficients in bold are significant at 10%**

	CU vs.					
	Mini		UCPR		CR	
	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)
Intercept	-2.101		<b>8.482</b>		<b>-37.479</b>	
<b>G: Group characteristics</b>						
Average age of the users' group (P)	-0.232	0.793	<b>-0.162</b>	0.85	0.198	1.219
Average size of the flock in the user' group(P)	-0.006	0.994	-0.01	0.99	<b>0.033</b>	1.034
Heterogeneity in age(P)	-0.226	0.797	0.837	2.31	-1.614	0.199
Heterogeneity in flock size(P)	-1.045	0.352	<b>1.766</b>	5.848	-0.983	0.374
Majority live in city with activities other than agriculture and livestock(P)+	21.281	0	1.177	3.243	25.615	0
Majority live in city with agriculture or livestock activities(P)+	<b>-3.632</b>	0.026	-1.049	0.35	-0.26	0.771
Percent of the users' group, producing dairy and livestock together(P)	4.189	65.962	-0.38	0.684	<b>8.884</b>	7,215.024
<b>V: Village characteristics</b>						
Name of city (P)+	<b>3.349</b>	28.47	1.236	3.442	<b>3.69</b>	4.063
Type of the village (V)+	1.107	3.024	-0.184	0.832	-2.715	0.066
Population density (V)	<b>-88.681</b>	0	<b>-16.945</b>		<b>-43.67</b>	0
<b>R: Resource characteristics</b>						
Summer land in mountain (P)	<b>2.258</b>	9.56	0.569	1.766	0.782	2.187
Winter lands in plain (P)	0	1	-0.001	0.999	-0.918	0.399
Spring land in corridor (P)	<b>4.49</b>	89.154	<b>2.265</b>	9.631	-1.147	0.317
Prob>Chi²						0.000
Cox and Snell						0.858
Nagelkerke						0.916
McFadden						0.706

**Table 40: Estimation result for the probability to implement the CU; +Dummy variables; (P) Variable measured at the level of rangeland parcel; (V) Variable measured at the level of village, Coefficients in bold are significant at 10%**

		Mini vs.					
		UCPR		CU		CR	
		Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)
Intercept		9.583		1.101		<b>-35.377</b>	
<b>G: Group characteristics</b>							
Average age of the users' group (P)		0.07	1.072	0.232	1.261	<b>0.43</b>	1.537
Average size of the flock in the user' group(P)		-0.004	0.996	0.006	1.06	<b>0.039</b>	1.04
Heterogeneity in age(P)		1.064	2.897	0.226	1.254	-1.387	0.25
Heterogeneity in flock size(P)		<b>2.811</b>	16.632	1.045	2.844	<b>0.062</b>	1.064
Majority live in city with activities other than agriculture and livestock(P)+		-19.104	0	-20.281	0	4.335	76.302
Majority live in city with agriculture or livestock activities(P)+		2.583	13.233	<b>3.632</b>	37.779	<b>3.372</b>	29.13
Percent of the users' group, producing dairy and livestock together(P)		-4.569	0.01	-4.189	0.015	4.695	109.382
<b>V: Village characteristics</b>							
Name of city (P)+		-2.113	0.121	<b>-3.349</b>	0.035	0.342	1.407
Type of the village (V)+		-1.291	0.275	-1.107	0.331	<b>-3.822</b>	0.022
Population density (V)		<b>71.736</b>	0	<b>88.681</b>	0	<b>45.011</b>	0
<b>R: Resource characteristics</b>							
Summer land in mountain (P)		<b>-1.689</b>	0.185	<b>-2.258</b>	0.105	<b>-1.475</b>	0.229
Winter lands in plain (P)		0	1	0	1	-0.918	0.399
Spring land in corridor (P)		<b>-2.225</b>	0.108	<b>-4.49</b>	0.011	<b>-5.638</b>	0.004
Prob>Chi²							0.000
Cox and Snell							0.858
Nagelkerke							0.916
McFadden							0.706

**Table 41: Estimation result for the probability to apply Mini; +Dummy variables; (P) Variable measured at the level of rangeland parcel, (V) Variable measured at the level of village, Coefficients in bold are significant at 10**

## **D Conclusions**

The Iranian rangelands have gone through many changes during the past decades, especially in terms of property rights of the local systems. Exogenous forces of the governments' policies were the major reasons for these alterations. During the years of the governmental enforcement to change nomadism to sedentarization, the traditional systems have been gradually eroded. Introducing the law of land reform was the last point in destroying the traditional systems. The chaotic system which resulted from breaking the local systems caused a large part of the Iranian rangeland to be degraded. To overcome this problem, the Iranian government designed an ecological plan - the rangeland management plan (RMP). The plan was designed based on equilibrium system theory driven by biotic factors. This theory indicates strong relations among rangeland productivity, livestock density and grazing capacity.

After 25 years of the introduction of the RMP, the Technical Office of Rangeland presents that in 2006 about 25% of the Iranian rangelands have been adopted. The study evidences from Semnan Province illustrates that, for many villages, the RMP is in either the third or the fourth phase of diffusion. Comparing the results of this study with the official information, the results can be generalized for most parts of Iran. It is therefore expected that most of the villages, especially those that are important in livestock husbandry, are in either the third phase of early majority adoption or the fourth phase of the late majority adoption. This result addresses that the RMP has been relatively successfully diffused among early adopters, and now the diffusion depends strongly on the communication between the actual adopters and the potential adopters. Additionally, the study revealed that economic factors, especially occupation opportunities, influence the rate of the RMP adoption. The villages with more job opportunities are expected to have a low rate for the RMP diffusion, while villages with the major job of livestock husbandry are expected to have a higher rate of the RMP diffusion. It is expected that any situation which influences the perception of importance of the RMP has an effect on the speed of RMP distribution among the rangeland holders. However, one recommendation for further studies might be to identify other factors influencing RMP diffusion.

The results from the qualitative survey on the perception of and experiences with the RMP reveal that many of the RMP holders do not use the suggested regulations in their practical management. According to the field observations, the receipt of loans and acquired possessions of grazing licences with a longer duration (e.g. 30 years) instead of only few years motivated RMP holders to apply the RMP. Normally the grazing license has to be renewed annually. The obtained results are conform with the diffusion theory addressing “relative disadvantages”, “non-observability” and “compatibility” as the main reason for non-adoption. Disadvantages were the lack of accessibility to common rangelands during non-grazing seasons, the high adjustment costs and the decreased economical benefits in terms of reducing the number of livestock. These three elements were realized as the main barriers to apply the RMP in their actual management.

Landholders’ adoption of sustainable management programs depend on their expectation of the program to develop their goals which vary from economical objects to social and environmental purposes (Pannell 2006). Before they implement the plans, they want to observe the potential outcomes and benefits. The more the potential outcomes and benefits are visible the higher the likelihood to be employed by potential adopters. The study revealed that non-visibility of potential outcomes and benefits is another reason for reduced motivation to participate in the plan. These potential outcomes and benefits are in general e.g. positive effects on plant vegetation such as soil improvement, positive rangeland trend (in terms of time length) and improvement of the forage vegetation, in particular palatable species.

The results indicate that the structure of the RMP is not consistent with the local knowledge. This is especially true in terms of the improvement programs and the grazing systems suggested by the RMP. The RMP was designed in accordance with the influence of humans on the rangeland degradation. Interestingly, the findings from the qualitative survey illustrate that a significant part of the local population does not perceive human impacts as a possible reason for rangeland degradation. This perception might cause a lack of acceptance of the RMP. From the view of respondents, rainfall reduction and drought is the main factor for

rangeland degradation. Therefore, it is recommended to conduct an in-deep monitoring of specific drought cycles as well as the long-term impact of droughts on dynamic of property regimes. With consideration to the fact that locating in the non-equilibrium environment is a major concern for all rangelands in arid and semi-arid regions, it is strongly recommended to investigate whether the Iranian rangelands meet the non-equilibrium conditions. Even if the conditions of non-equilibrium were not approved, drought management should be still a major purpose in any improvement plan.

Additionally, the respondents were not convinced that the improvement programs have indeed significant influence on the plant vegetation of the managed land. However, due to the fact that these two issues seem to be an important precondition for the practical acceptance of the plan, action should be initiated. The lack of practical acceptance might be simply caused by the lack of knowledge about the effects of the plan. Public events should be established and it should be made sure that the local population has access to this information. A study conducted a study in 15 provinces including Semnan (Hedjazi 2007), illustrates that training sessions, TV and radio programs, symbolic ceremonies and organization of cooperative groups are effective in distributing the information among the rangeland holders.

According to the empirical results, two further reasons for not implementing the RMP are the lack of trust to the government and the type of ownership. Comparing our results with the literature, the lack of trust to the governmental system appears also in other studies as a barrier to adoption of agricultural programs (e.g. Rae (2005), Van Kooten and Thomsen (2006)) identified the lack of trust as a significant factor influencing the disagreement of ranchers with public agency managers. In our study, the neglect of the government to fulfill its commitments raised local uncertainty to governmental programs.

According to the literature, a solution to the problem of rangeland degradation might be privatization. However, the rangeland holders did not present a dramatic interest in privatizing rangelands. But it was found that the interest of rangeland holders for privatizing summer lands was greater than for the winter lands or



spring lands. However, reasons for this preference could not be identified in this study.

Even if it can be proved that rangeland degradation is serious and has been caused by excessive number of livestock, there has been little research on the reasons for overstocking. Most of the studies associated with rangeland degradation have simply suggested reduction in the number of livestock (Abdolahpour 2001; Azadi 2005; Badripour, Eskandari et al. 2006). Questions on the motivation and reasons of livestock holders to have excessive numbers of livestock remained so far unanswered. The empirical results of Semnan rangelands reveal that RMP holders developed their own regulations, although they have officially applied for the RMP. A major part of local institutions associated with rangeland management are still in the form of strategies and have not been internalized as norms. Based on this results it can be concluded that the local institutions *are still in transition*. This can be seen as a great chance due to they have the opportunity to improve the existing institutions associated with rangeland management, or even to establish new institutional rules.

Based on the results of the case study, it can be concluded that the rangeland holders developed property strategies to regulate the right “to use” and the right “to manage” the rangeland resources. While the right to use rangeland resources is owned by livestock holders, the right to manage rangeland resources is owned by the manager who decides on the type of grazing strategy. The rangeland holders developed their strategies for the purpose of regulating “livestock production”, “property rights” and “protection against outsiders”. The “property strategies” aimed at regulating use and management of common resources. The “production strategies” aimed at regulating the livestock behaviour. The “protection strategies” aimed at protecting the rangeland from non-members. The “property rights” are the most important due to addressing the “Property in Use Regimes” (PUR).

Developing various property strategies by groups of rangeland holders addresses diversity of PURs, although the unique form of the “Common Property Regime” under the state ownership is officially defined for almost all of the Iranian rangelands. For the study region of Semnan, the “rangeland division”, “rotational

use” and “only one manager” were the main property strategies developed by the rangeland holders. Accordingly, the four PUR of “Unregulated Common Property Rights” (UCPR), “Common property with rotational use” (CR), “Common property with Unique decision maker” (CR) and “Mini CPR within CPR” (Mini) were determined. The four forms of property regimes can be put in direct line with the following final points of UCPR and CU. The UCPR with the limited number of rangeland users and no regulation are identified as very close to the open access. The CU with only one manager is identified as close to the private property regime. The two other property regimes of CU and Mini can be located between the CU and UCPR without mutual order.

Among the three investigated characteristics, the following variables turned out as the main determinants of selecting a PUR:

Among the variables related to the **resource characteristics** *access and management rights* turned out to be very important *determinants* of selecting a PUR. Spring rangelands in the mountainous region increase the probability of UCPR or Mini regime. The lack of individual exclusion in spring rangelands can be expected because of their location. In Semnan Province, the spring rangelands are located some where between the winter rangelands and the summer rangelands. Indeed, they are like corridor lands for travelling from winter rangelands to summer rangelands, and vice versa. Therefore, the livestock holders have to pass across the spring rangelands to reach the other part what makes a clear land division very difficult. The impact of the grazing season on the rangeland management has been also observed in other regions (Banks T. 2001).

Among the variables related to the **group characteristics**, *heterogeneity in the size of flock* was the key determinant influencing the emergence of the PUR. According to the results of the econometric model, increase in heterogeneity in flock size is expected to raise the probability of creating UCPR. Literature on the impact of the socio-economic heterogeneity on the management of the common pool resources suggests two contrary views: induce group cooperation (Olson M.J. 1965) or impede group cooperation (Dietz T. and Dolsak N. 2002). The results of our study support the idea that the group heterogeneity in flock size

reduces the group cooperation, and as an effect of this, the establishment of the group regulations. However, reasons for this could not be identified from the empirical results. Therefore, it is recommended to do further research on the process of influencing the flock heterogeneity on the decisions of the users.

Among the variables related to the **village characteristics**, *population-density* was the strongest determinant. The population density that increases the village demand for livestock promotes the preferences of the group to rangeland division. Therefore, increase in population density of village raises the probability of transferring non divided rangelands (CU and UCPR) to divided rangelands (e.g. Mini and CR). The obtained result is consistent with the theory of property rights which hypothesises that resource scarcity increases the probability of emerging strict rules and regulations.

The explorative survey revealed that the off-occupation (having a job in another field than agriculture) plays an important role in the choice of local institutions. The regression analysis indicates that the groups of which the majority of the members live in city with the major occupation of livestock activities, are most likely to select the CR or CU. However, the results of the regression do not indicate the possible selection of the groups of which the majority of the members live in city with occupation other than agriculture. Since livestock husbandry was the main income source in the study villages, the impact of the off-occupation should be viewed sceptically. Given that some villages in Semnan have been developed by small industrial factories (e.g. mines and chemical factories), it is recommend to conduct more research on the two different village types: villages with livestock husbandry and villages with small industry as the major economic activity.

Based on the empirical results, it is concluded that the current controlled market can not be a reason for the diversity in the PURs among the group of users. Although the impact of price and geographical distance as proxy for access to the market was not clarified by this cross-sectional study, long term consideration in terms of a dynamic study on the implemented strategies and market conditions in terms of relative prices and access to markets are required. Reasons for the

exclusion of this issue in the case study were the controlled prices and similar distances for all study parcels and therefore the lack of variance for a sense full analysis of determinants.

For many years the causes for rangeland degradation has been attributed to the three dilemmas of “overgrazing”, “overexploitation” and “untimely grazing” on which the theoretical framework as well as the conceptual model based. The influence of local management strategies, especially property strategies, on these dilemmas is recommended as a task still ahead.

In the light of the results of this study, to overcome the problem of rangeland degradation, it is required to look at the rangeland itself and the local strategies used by the actual users. For those regions with special conditions, for instance extremely poor conditions or very excellent conditions, it is helpful to have a very deep understanding about the structure of the group-established strategies, especially the property strategies at a small scale. To achieve this purpose, it is required to investigate the internal dynamics of the group-established strategies as well as local knowledge about ecological, social and economic conditions on which the emerged strategies are based. This deep understanding of institutional environment and their internal dynamics is also essential for the policy makers if they intend to improve the ecological conditions of rangelands through sustainable management programmes. Any type of technical improvement based on grazing systems, carrying capacity and stocking rate have little sense if they ignore the institutional arrangements that facilitate incentives for conducting the program.

Besides paying attention to the local knowledge and the institutional environment, it is necessary to analyse the systems in a broad scale and to achieve general outcomes in terms of large number of cases. For instance, we suggest designing models regarding the driving factors on the group-established strategies under specific conditions such as extremely poor conditions and very excellent conditions. By designing this type of models, it can be identified how far the structure and function of rangeland management differ in various conditions. It is true that most of the factors associated with institutions, economy and policy are contextual and therefore are difficult to measure. However, in many situations, the

contextual information is transferable to numerical codes that can be used for constructing indicators as representatives for immeasurable variables using econometric and statistical approaches. The most important point is that different purposes require different indicators from different perspectives. To obtain reliable information from the estimated indicators, they should be individually interpretable and collectively comprehensive. Therefore, the process of exploring variables, such as associated variables with “resource characteristics”, “group characteristics” and “village characteristics”, to construct indicators is a very difficult decision, and requires to be based on a clear understanding of the assessment purposes and a deep understanding of the institutional environment.

Taken together, developing the combined approaches of qualitative and quantitative methods enable the researcher to analyse the systems in a broad scale and with a large number of cases that increase the accuracy of the obtained outcomes. This approach relies not only on the pre-defined variables and ready-made data set such as time series data, but on the empirical observed variables and collecting data sets through different forms of interviews and field observations. Additionally, using combined approaches of qualitative and quantitative methods enables the analyst not only to describe the structure, but also to compare the different situations, conditions and factors in terms of robustness of linkages and relationships. This can be done by econometric tools to withdraw a general understanding of operating institutions in a broad scale, finding how the driving factors influence their selection, and analysing how strong is any factor, compared to others, on the structure of the property regimes.

To overcome the problem of rangeland degradation, it is required to find the government’s role in managing rangelands and how the government can play an effective role in achieving a sustainable management plan. For the case of the Iranian rangelands, the role of the government has usually been inappropriate and has rarely led to improvement. It is clear that the Iranian policy is not intending to return to the traditional nomadic pastoralism over large spatial scales. This would also not be feasible with the on-going socio-economic development taking place in pastoral regions. However, finding an answer to the question how the

government can play an effective role in the transition way requires more studies and research on the relationship between the government and communities in the present time. Based on the overall results of the study, it can be concluded that the design of effective rangeland management plans requires selective policies that consider the actual situations of the local users. The ‘uniform policy for all situations’ without consideration on the complex characteristics has many limitations. The flexible and innovative systems of the local management require plans which are based on the community needs at each stage.

An alternative to the policies of the government might be a self-regulated system. Even if the common nature of rangeland resources, the diversity of interests of the local users, and the transaction costs of negotiation might be a challenge in a self-regulated system (Houtte A.V. 2001; Macadam R. and Drinan J. 2004; McAdams and Rasmusen 2007), applying this policy is still an effective option. Implementation of this system requires the government to support the rangeland holders in establishing their own system, and provide them with some facilities in which they have difficulty, such as establishing enforcement system, sanctions and provision of necessary information. By applying this policy, the needs of the rangeland holders, such as changes in the income situation e.g. getting cheaper loans for equipment or finding additional occupation opportunities to should be considered. The lack of trust towards the government supports the suggestion for the implementation of this policy.

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## Annex

### Appendix 1 (The first Questionnaire)

Community name -----

No. community-----

#### Questions for determining community boundary <sup>66</sup>

1- What basis is for recognizing different communities?

2- Asking them to draw a simple sketch of their community land with some details in grazing areas, and their conditions, also, cropping area, and their production.

3- Specifying distances from community boundary to water location, different permanent settlement, villages, and others which are important.

4- Are there different groups in the community? Yes..... No.....

5- If yes, how many groups? .....based on what?

6- Where are their boundaries, showing with a simple from.

Report about GPS points from community boundary

Description of the point(name of the village/settlement)	Way point number	latitude	longitude

#### Questions for determining the level of trust within communities <sup>67</sup>

1- Do they prefer to have more land shared with other people or to have an own land?

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<sup>66</sup> This part was not used in the analysis due to being unclear to the rangeland holders.

<sup>67</sup> This part was not used in the analysis. For the first four questions, a few respondents were interested in answering them.



2- If the second answer has chosen, how many people would they prefer for sharing the land?

3- Do they prefer to share the land with?

- ☐ Their relatives
- ☐ Community members
- ☐ others

4- How many people can they accept for sharing the land?

5- How often do you think that their chief to consider his benefits or his family benefits instead of community benefits?

- ☐ Often
- ☐ Sometimes
- ☐ Seldom
- ☐ Impossible

6- Who can oppose the chief decisions or actions?

- ☐ Every body in the community
- ☐ A specific group of the community
- ☐ Nobody

7- If something has been happened in the community that is not acceptable with the others who can ask him about it?

- ☐ Every body in the community
- ☐ A group enforcing the common rules
- ☐ Governmental organization

### **The situation of informal rules**

1- Do any community rules and regulations exist in the community?

.....Yes

.....No

2- If yes, for what objectives they have been established?

3-What do you feel about your own rules? Do you feel any obligation in obeying them?

4-What will happen if a person does not obey the rule? Do you have any sanction for this purpose?

5- how many rules exit in each category?

.... Number of livestock a community member can take to grazing lands.

..... Using efficiently watering resources

... Making investments in protecting and preserving rangelans.

....Others

### **Degree of community friendship with the government <sup>68</sup>**

1- How many local governments do they know in the area?

2- Explain more about their organizational tasks?

3- Has the community access to local offices?

4- If yes, how is the system?

....individually

....community request

....community chief

....others

5- Can they connect individually/jointly connect to centralized state?

....yes     ....no

6- Is there any local organization where provides this facility ( connecting to centralized state)?     .....yes     .....no

7-If yes, how many organizations?

### **Development performance <sup>69</sup>**

1- Do they think that their communities have been developed during the last five years?

.....Yes                .....No

---

<sup>68</sup> This part was not used in the analysis. For the first four questions, a few respondents were interested in answering them.

.....livelihood stability  
economical gap between poor and rich people  
..... Others

.....Poverty reduction  
.....quality of public services  
.....Reducing the

1- What are the main socio-economic problems in their communities?

2- From their view of point, would it be possible to rank economically the community members?

3- If yes, what would be their indices?

4-how many households have been known as rich families?.....

5- How many households have been known as poor families...

7- How is the degree of educational situation in the communities?

.....number of people having 4 or 5 formal education

<sup>70</sup> This part was not used in the analysis due to being unclear to the rangeland holders.

### **Rangeland Management:**

1- What are their main obstacles to manage effectively rangeland? (help them with the following items, if they do not have any answer)

.....livelihood stability

..... being too high environmental risks

..... trembling poor members' right by rich members

..... The lack of effectiveness of community leadership

.....The lack of effectiveness of formal/informal rules

..... Others

### **Outcomes can be obtained by community cooperation<sup>71</sup>**

1- Do they think that the degree of community cooperation influence governmental grants to your community?

.....absolutely      .....Maybe      .....rarely      .....Not at all

2- If it would be possible, what types of extra grants can be obtained from the government by collective requests?

....getting public work employment

.....gaining extra livestock feed resources

.....getting more financial subsidies in

... Reducing poverty

.. ....making investments in improving rangeland

.....more public services

...education      ....health facilities      ....clean drinking water ...others

### **Added questions during the field study**

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<sup>71</sup> This part was not used in the analysis due to being unclear to the rangeland holders.

1. Why have you chosen livestock husbandry as a job?
2. -Why do you continue this job, in spite of being unbeneficial? (Follow up question)
3. How do you use the rangeland?
4. Do you (yourself) have any rule for herding your flock?
5. Does your group have any rule for herding the flock?
6. -What do you think about rangeland condition during the time?
7. What about governmental rules? How do you evaluate them?
8. Do you agree with governmental rules?
9. From your view of point, why do some people leave livestock husbandry?
10. What do you think about insurances?
11. What would you do if you were faced with drought?
12. How many years are you facing drought during the last ten years
13. How did you change the number of your flock within the drought years?
14. How do you sell your products? Where is the market? What do you think about the prices?
15. Problems you have using rangeland? From your point of view, how can the condition of the land be changed?
16. Other considerations

## Appendix 2

### The Second Questionnaire (the user group)

Name of the village.....

Table1.Age structure of the group<sup>72</sup> in the current year

Name of the parcel	Nr.of users under 20-40 years old	Nr. Of users between 41-55years old	Nr. Of users more than 55 years old	The youngest user	The oldest user

Table2.Group education (in the current year)

Name of the land parcel	Nr. of users can not read &write	Nr. Of users having the following certification					The highest degree in the group	The lowest degree in the group
		Elementary school	Secondary school	High school	Diploma	university		

<sup>72</sup> All information is relatd to users who have livestock

Table3.Different tribes in the group (in the current year)

Name of the parcel	Nr. of users from					Nr. of tribes in the group	Nr of users from the most common tribe in the group	Nr.of users from the least common tribe in the group	Other considerations
	Extended family 1	Extended family 2	Extended family 3	Extended family 4	Extended family 5				

Table4.Living places (in the current year)

Name of the parcel	Nr. of places where the users live		The most Nr. of users who live in the same village/city		The least nr. of users who live in the same village/ city		Nr. of users live in the city	Nb of users from the surveyed village
	Nr. of cities	Nr. of villages	Nr. of users	Name of the village/city	Nr. of users	Name of the village/city		

Table5.Group accessibility to different lands(S=summer, W=winter, C=corridor)

Name of land spot	Nb of users who use farm lands	If the land is summer			If the land is winter			If the land is corridor		
		Nr. of users having			Nr. of users having			Nr. of users having		
		S+W	S+C	all	W+S	W+C	all	C+S	C+W	all

Table6.Heterogeneity in the number of livestock in the last period of grazing

Name of the Land parcel	Nr of the users go to the land	Nr. Of herds in the following categorises					Nr. Of shepherds working for a user.	Nr. Of livestock in the biggest herd	Nr. of livestock in the smallest herd
		1-50	51-100	101-150	151-250	More than 250			

Table7.

Name of the parcel	Total Nr. of heads	Total Nr.of goats	Total Nr. of sheep	Total Nr. of cows

Table8.Other income-earning resources in the group (for those who come to the land)(in the current year)

Name of the parcel	For users who breeding livestock is their first job					For users who livestock husbandry is not their first job				
	Nr.Of users do only farming beside	Nr .of users are just state employee	Nr.of users work for only factory/mines beside livestock	Nr. Of users do only private jobs like driving...beside livestock	Nr. Of users do farming+ other jobs	Nr. Of users do only farming	Nr.of users are just state employee beside	Nr.of users work for only factory/mines beside	Nr. Of users do private jobs like driving,...	Nr. Of users do farming +other jobs



	Livestock husbandry	Beside livestock husbandry	husbandry	husbandry	beside livestock	beside Livestock husbandry	Livestock husbandry	Livestock husbandry	beside Livestock husbandry	beside livestock

Table9.Other income-earning resources for those who do not come to the land but send an employed shepherd (in the last grazing period for winter/corridor lands; in the current grazing period for summer lands)

name of land parcel	Nr. of users do not come to the land	What is their job?  (Given that Nr, of this people would not be high and I have no idea about their jobs; I do not determine any job for them.)

Table10.Land management (firstly, good/bad years should exactly be determined by the official office within the past 5 years)

Name of the parcel	Actual Entrance time		Actual Exit time	
	For the year..... (good year)	For the year.....(bad year)	For the year.....(good year)	For the year.....(bad year)

Table11.Plantation/ protection programs

Name of land parcel	Improvement programs within the last 5 years					Size of protected area in your land in the current year	
	Nr. of plantation programs	Nr. of seeding programs	Nr. of water improving programs	Nr of ..... Program	Nr of ..... Program	Because of your plan	Because of range management plan

Table12.Property right system (in the last grazing period for winter/corridor lands; in the current grazing period for summer lands)

Name of the parcel	Do you use it in the last 5 years?	Having locally internal boundaries on the land	Nr. of sub-groups	Is there any specific relationship between the members of a sub-group (extended family, relatives...)	Nr. Of users within a bounded area (Nr. Of users within sub-groups)						
					Group1	Group2	Group3	Group4	Group5	Group6	Group7

Table13.Nomad's accessibility

Name	Do	If yes, why are they allowed to come to the land	Staying time in the recent year?	Nr of livestock they	Nr. of years

	Watering their herd
	Caring their herd
	Traditional rules
	Legal rule that identified a certain path for their herd
	others
	Just passing through the land
	Came in grazing month
	Came in Non-grazing month
	Nr of months that they can stay in this year

Table14.Land Neighbours' accessibility (neighbours from the same village)

	Name of the parcel		If yes, why are they allowed to come to the land		Staying time  In the recent year
	Do land neighbours are allowed to enter land?				
	If yes, Nr. of neighbours				
	Name of Neighbour's land				
	Watering their herd				
	Grazing their herd				
	Traditional rules				
	others				
	Just passing through the land				
	Came in grazing months				
	Came in non grazing months				
	Nb. Of months that they stay in this year				
	Nr. of livestock they took/ take in the recent year				
	Nr. of years that they come the land throughout the past 10 years				

Table15.Other Villages' accessibility

Name of the respondent	Do any villagers have access to the land?	If yes, Nr. of villagers	If yes, why they are allowed to come to the land	Staying time in the recent year	Nr. of livestock that they have	Nr. of years that they have been there

			Name of villages???										
			Watering their herd										
			Grazing their herd										
			Traditional rules										
			Legal rules that identified										
			others										
			passing through the land										
			Come in grazing time										
			Come in non-grazing time										
			Nr. of months they stay										

Table16.Group's accessibility to other range lands

	Name of the parcel		Does any of the group who could take his animals on		If yes,		If yes, for what they are allowed to go to the land		Staying time	
			Name of the land							
			Nr. of users could use the land							
			Watering their herd							
			Grazing their herd							
			Traditional rules							
			others							
			Passing through the land							
			Nb. Of moths/days they stay in the current year							
			Nb of livestock they take in the grazing period							
			Nb of years they have used the land within the last 1 years							

Table17. Calendar of presence: Nb of animals present on the land spot

name of land spot	mordad		Tir		Khordad		ordibehesh t		Farvardin		Esfand	
	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock

Name of the spot	Bahman		day		Azar		Aban		Mehr		Shahrivar	
	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock	Nb of days	Nb. Of livestock

Table18. Informal Rules &amp; Regulations

Name of the land	Having rotation rule (individually rotating land spots among users' group)	Having exit rule (all users exit the land at the same day)	Having entrance rule ( all users come to the land at the same day)	Mixing their livestock

Table19.Informal rules &regulations:

Name of the land	Employing shepherd, jointly	Employing Mokhtabad, jointly	others

Table20.Monitoring rules against outsiders:

Name of the land	Nr. of months the land is ungrazable due to fire	Do you control use of the land from outsider	If No, why not?

**Table21.Is control of the land organized by yourselves? If yes, follow the table:**

Name of the land	Do you use rotational rules? If yes, complete this					Do any of users control the land because of being close to the land? If yes, complete the following				
	in the past 5 years?	For Grazing season in the recent year		For non-grazing season		In the past 5 years?	for garzing season		For non-Grazing season	
		Nb. Of users do it	Nb.of months in the recent year?	Nb.of users cooperate	Nb.of months in the recent year?		Nb. Of months in the recent year	Nb. Of users that cooperate	Nb. Of users do	Nb. Of months in

Table22.Do you employ a local guard to protect the land? If yes, complete the following table

Name of the land spot	In the past 5 years?	For grazing seasons				For non-grazing seasons			
		Nb. Of guards	Nb. Of months	Your payment	State payment	Nb. Of guards	Nb. Of months	Your payment	State payment

Table23.Do you use any other monitoring rules in the past 5 years? (If yes, follow the table)

Name of the land	The way they use	In the recent year					
		For grazing seasons			For non-grazing seasons		
		Nb. Of users/guards	Nb. Of months	payments	Nb. Of users/guards	Nb. Of months	payments

Table24.Monitoring the rules in the group

Name of the land spot	Do users in your group look over each other?	Do you have any other rules to see what the others do?

Sanctions:

Table25.If a user takes livestock more than his permission, by whom and who will he be punished?

Name of the spot	If there are sub-groups, do they have the same	By the group		By the community		By the range office		others	
		For how many livestock	What is the sanction	For how many livestock	What is the sanction	For how many livestock	What is the sanction	For how many livestock	What is the sanction

Table26.If a user takes their livestock in non-grazing season, by whom and who will he be punished?

	If there are sub-groups, do they have the same	By the group		By the community		By the range office		others	
		For how many days	What is the sanction	For how many days	What is the sanction	For how many days	What is the sanction	For how many days	What is the sanction



Table27.If a user rent his proportion of land to others, by whom and who will he be punished?

Name of the spot	If there are sub-groups, do they have same	By the group		By the community		By the range office		others	
		For how often he does	What is the sanction	For how often he does	What is the sanction	For how often he does	What is the sanction	For how often he does	What is the sanction

Table28.Other violations

Name of the spot	Explain possibly violation other than the mentioned one	By who, the violator will be punished?	What is the sanction?

## Water resources condition

Table29.For lands without any water points:

Name of the spots	Where do they go to water their livestock	Other can use the source			
		Nr. of villages	Nr. of groups	Nr. of users	
				In the	Out

				group	of the group

Table30.Stream points:

Name of the land spot	Nr. of stream points	Stream points Nr.	Nr. Of months having water	Nr.of users in the group having access to it	Nr. Of users out of the group having access to it
		1-			
		2-			
		3-			

Table31.Well points:

Name of the land spot	Nr. of well points	Well points	Nr. Of months having water	Nr.of users in the group having access to it	Nr. Of users out of the group having access to it

Table32.Water store points:

Name of the land spot	Nr. of stores	Store point Nr.	Nr. Of months having water	Nr.of users in the group having access to it	Nr. Of users out of the group having access to it


Table33.Other points to water the livestock:

Name of the land spot	Name of the point	Nr. of points	points	Nr. Of months having water	Nr.of users in the group having access to it	Nr. Of users out of the group having access to it

Table34.Selling production:

Name of the land spot	Nr. of users who sell only meat	Nr. of users who sell only dairy products	Nr. of users sell both	Nr. of users sell other production↓			
				Product:	Product:	Product:	

## Questionnaire translated in Farsi

پرسشنامه برای بهره برداران

ساختار سنی بهره برداران از یک سامانه عرفی (در سال اخیر)

نام سامانه عرفی	تعداد بهره برداران بین 20-40 سال	تعداد بهره برداران بین 41-55 سال	تعداد بهره برداران بیش از 55 سال	جوان ترین بهره بردار	مسن ترین بهره بردار

سطح تحصیلات بهره برداران (در سال اخیر)

نام سامانه عرفی	تعداد بهره برداران که قادر به خواندن و نوشتن نیستند	تعداد بهره برداران با مدارک زیر					بالا ترین مدرک تحصیلی	پایین ترین مدرک تحصیلی
		دانشگاهی	لیسانس	دبیرستان	راهنمایی	دیپلم		

تنوع طایفه ای در گروه بهره برداران از یک سامانه عرفی

نام سامانه عرفی	تعداد بهره برداران که از یک خانواده هستند					تعداد طایفه ها در گروه بهره برداران	تعداد بهره برداران که متعلق به اصلی ترین طایفه هستند	تعداد بهره برداران که متعلق به کوچکترین طایفه هستند	موارد دیگر
	خانواده 1	خانواده 2	خانواده 3	خانواده 4	خانواده 5				

مکان های زندگی یک گروه بهره بردار از یک سامانه عرفی

نام سامانه عرفی	تعداد مکانهایی (شهرها و روستاها) که گروه بهره برداران از یک سامانه زندگی می کنند	نام شهر /روستا که بیشترین تعداد بهره برداران از آن مکان آمده اند	تعداد بهره برداران که از آن مکان آمده اند	نام شهر /روستا که کمترین تعداد بهره برداران از آن مکان آمده اند	تعداد بهره برداران که از آن مکان آمده اند	تعداد بهره برداران که در شهر زندگی می کنند	تعداد بهره برداران که متعلق به منطقه مورد مطالعه هستند

[illegible]

میزان دستیابی گروه بهره‌بردار از مراتع دیگر (ت = تابستانی، ز = زمستانی، م = میان‌بند)

نام سامانه عرفی	تعداد بهره برداران که از زمین کشاورزی استفاده می کنند	اگر مرتع تابستانی است			اگر مرتع زمستانی است			اگر مرتع میا نبند است		
		تعداد افرادی که به مراتع زیر دستیابی دارند			تعداد بهره بردارانی که به مراتع زیر دسترسی دارند			تعداد بهره بردارانی که به مراتع زیر دسترسی دارند		
		ت+ ن	ن+ م	همه نوع	ت+ ن	ن+ م	همه نوع مرتع	ت+ ن	ن+ م	همه نوع مرتع

تفاوت بین بهره‌برداران از نظر تعداد دام

نام سامانه عرفی	تعداد بهره برداران که به مرتبه می روند	تعداد گله هایی که تعداد دامشان	تعداد د چوپانیهایی که برای بهره برداران کار می کنند
		50 تا 1	
		51 تا 100	
		101 تا 150	
		151 تا 250	
		پیش از 250	
		بهره بردار 1	
		بهره بردار 1	
		بهره بردار 2	
		بهره بردار 3	
		بهره بردار 4	
		تعداد دام در بزرگترین گله	
		تعداد دام در کوچکترین گله	

تعداد دام که در یک سامانه عرفی چرا میکنند

نام سامانه عرفی	کل تعداد دام	کل تعداد بز	کل تعداد گوسفند	کل تعداد گاو
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منابع دیگر در آمد در یک گروه بهره بردار

نام سامانه عرفی	بهره بردارانی که اصلی ترین شغل آنها دامداری است					بهره بردارانی که دامداری شغل دوم یا سوم آنها محسوب می شود				
	تعداد بهره برداران که در کلان دامداری فقط کشاورزی می کنند	تعداد بهره برداران که در کلان دامداری، کشاورزی+بشقابهای	تعداد بهره برداران که در کلان دامداری فقط کار	تعداد بهره برداران که در کلان دامداری فقط در معن یا	تعداد بهره برداران که در کلان دامداری فقط کار	تعداد بهره برداران که در کلان دامداری، کشاورزی+بشقابهای	تعداد بهره برداران که در کلان دامداری فقط کار	تعداد بهره برداران که در کلان دامداری فقط در معن یا	تعداد بهره برداران که در کلان دامداری فقط کار	تعداد بهره برداران که در کلان دامداری، کشاورزی+بشقابهای

منابع دیگر درآمد برای آنها یی که وارد مرتع نمی شوند، اما چوپانان خود را به مرتع می فرستند ( در آخرین فصل چرا)

نام سامانه عرفی	تعداد بهره برداران که وارد مرتع نمی شوند اما چوپانهای خود را به مرتع می فرستند	شغل اصلی آنها چیست

مدیریت زمین از لحاظ فصل چرا(زمان ورود و خروج دام) در سالهای خوب و بد

نام سامانه عرفی		زمان ورود		زمان خروج	
		در سال .....(بعنوان سالی خوب)	در سال .....(بعنوان سالی بد)	در سال .....(بعنوان سالی خوب)	در سال .....(بعنوان سالی بد)

برنامه های حفاظت و بوته کاری

نام سامانه عرفی	برنامه های اصلاح و احیا در طی 5 سال گذشته	چند هکتار از زمین شما قرق شده

است به دلایل زیر							
تعداد برنامه های بوته کاری	تعداد برنامه های بندرپاشی	تعداد برنامه های ابخیزداری (مرمت چشمه...)	تعداد برنامه های	تعداد برنامه های	تعداد برنامه های	طرح مرتع داری	

سیستم مالکیت عرفی (در فصل چرای اخیر)

نام سامانه عرفی	ایا شما از این مرتع در 5 سال گذشته استفاده کردید؟	آیا مرتع را به صورت عرفی تقسیم کردید؟	تعداد محدودهای عرفی؟	تعداد بهره برداران از یک محدود عرفی						
				محدوده 1	محدوده 2	محدوده 3	محدوده 4	محدوده 5	محدوده 6	محدوده 7

دسترسی عشایر به مرتع مورد مطالعه

نام سامانه عرفی	ایا عشایر اجازه ورود به مرتع را دارند؟	در صورت مثبت بودن. به چه دلیل وارد مرتع می شوند؟				مدت توقف آنها در فصل چرای اخیر				تعداد دامی که آنها در فصل چرای اخیر وارد مرتع کردند	در 10 سال اخیر. عشایر چند بار به این مرتع دسترسی داشته اند؟
		استفاده از منابع آبی	چرای گله ها	رسوم عرفی	منابع طبیعی که مسیر مشخصی را برای عبور آنها تعیین کرده است	موارد دیگر	تنها عبور از مرتع	تعداد ماههای اقامت در فصل چرا	تعداد ماههای اقامت در فصل غیر چرا	موارد دیگر	

		Name of the village
		Size of the village (ha)
		Distance to the nearest city (km)
		Having transport road
		Nr. Of tribes in the village
		nb of extended families
		Nr.of rangeland spots in the village
		Total Nr. of households having access to land spots
		Other considerations

[illegible][illegible]



## Appendix 2

### Questionnaire 2(Village Questionnaire)

Migrated households:

Name of the village	Nr. Of residence households	Nr. Of migrated households						Total Nr. of households	
		Nr. of households living in other villages/cities but still using			Nr. of households living outside and possess the following rights but they didn't use it in the past 10 years.				Nr. of households living permanently outside and no link with the community
		Their farm land	Their rangeland	both	Farm land	rangeland	both		

Number of resources which are properties of the community

Name of the village	Rangelands (ha)	Other lands (ha)		Agricultural instruments (tractor, tank...) others			
		Irrigated	rain fed	Nr. of tractors	Agricultural instrument called....	Agricultural instrument called	others

## Rightful users

Name of the village	Nb rangeland user have right to use 'x' plots in the village					Nb rangeland user have right to use 'x' plots outside the village				
	0 plot	1 plot	2 plots	3 plots	...	0 plot	1 plot	2 plots	3 plots	...

Name of the village	Nb range users using agricultural lands for grazing livestock	Nb rangeland user using 'x' plots in the village					Nb rangeland user using 'x' plots outside the village				
		0 plot	1 plot	2 plots	3 plots	...	0 plot	1 plot	2 plots	3 plots	...

## Actual users

### Households with livestock

Name of the village	Nr. Of households go to the rangeland	Nr. of households do not go to the land	Nr of these households with the following livestock					What do they do with them?
			1-50	51-100	101-150	151-250	More than 250	

-Herd size heterogeneity:

village	Nr. Of herds in the following categorizes					Nr. Of livestock in the biggest herd	Nr. of livestock in the smallest herd
	1-50	51-100	101-150	151-250	More than 250		

Alternative income-earning resources:

Name of the village	Nr. of households doing Agriculture	Nr. of households doing Livestock breeding	Nr. of households working for factory	Nr. of households working for mines	Nr. of households doing Other jobs	

-Joint activities:

Name of the village	What activities do the villagers jointly conduct?

# Questionnaire translated in Farsi

## پرسشنامه مربوط به روستاهای مورد بررسی

**\*\*این اطلاعات در مرکز امار ایران موجود است.**

**جدول 1. اطلاعات مربوط به روستا**

نام روستا	اندازه روستا- اندازه اراضی مربوط به روستا (هکتار)	**فاصله روستا به نزدیکترین شهر (کیلومتر)	**آیا روستا جاده دارد؟	تعداد قایل های که در روستا زندگی می کنند؟	تعداد خانوارها (خانوارهایی که از یک قایل اند.)	تعداد سمانه های عرفی که به این روستا متعلق است	تعداد خانوارهایی که پروانه چرا برای استفاده از مرتع دارند	**تعداد خانوارهایی که از مراتع استفاده می کنند	مورد دیگر (در زمینه اداره روستا)

**جدول 2. وضعیت مهاجرت در روستا**

نام روستا	تعداد خانوارهای ساکن در روستا	تعداد خانوارهایی که مهاجرت کردند (در ده ساله اخیر)	تعداد کل خانوارها در روستا
	تعداد خانوارهایی که به روستاهای دیگر مهاجرت کردند ولی هنوز	تعداد خانوارهایی مهاجر که دارای هایی زیر را در روستا دارند ولی در طی 10 سال گذشته از آن استفاده نکردند	تعداد خانوارهای مهاجر که به صورت دایم در خارج از روستا زندگی می کنند و

از زمین های کشاورزی خود استفاده می کنند	
از مراعات خود بهره برداری می کنند	
از مرتع و زمین کشاورزی خود بهره برداری می کنند	
زمین کشاورزی	
مرتع	
هر دو	

نام روستا	اندازه مراتعی که متعلق به روستا هستند (هکتار)	زمین های دیگر که متعلق به روستا هستند		ادوات کشاورزی که متعلق به روستا هستند			
		زمین های آبیاری	زمین های دیم	تعداد تراکتور	وسایل کشاورزی با نام .....	وسایل کشاورزی با نام .....	موارد دیگر.....

نام روستا	نام مرتع روستا	تعداد روستاییانی که از این مرتع بهره برداری می کنند	تعداد روستاییانی که برای این مرتع پروانه چرا دارند

جدول 5. بهره برداران واقعی از مراتع روستاهای دیگر ( انهایی که دام دارند و به مرتع می روند)

نام روستای محل زندگی بهره بردار	نام روستا که مرتع در آن قرار دارد	نام مرتع روستا	تعداد روستاییانی که از این مرتع بهره برداری می کنند	تعداد روستاییانی که برای این مرتع پروانه چرا دارند

جدول 6. خانوارهایی که دامداری غیر وابسته به مرتع دارند

نام روستا	تعداد خانوارهایی که از مراتع استفاده می کنند (دامداری دارند)	تعداد خانوارهایی که دام دارند ولی از مراتع استفاده نمی کنند (دامپروری دارند)	متوسط تعداد دام در یک گله	تعداد گله ها در روستا	تعداد خانوارهایی که تعداد دام آنها به صورت زیر است						
					1-50	51-100	101-150	151-250	بیش از 250	حداکثر تعداد دام متعلق به یک خانوار	حداقل تعداد دام متعلق به یک خانوار

جدول 7. فعالیت های گروهی در روستا

نام روستا	فعالیت هایی را که روستاییان بصورت گروهی انجام می دهند

## Appendix 3

The handbook of the Rangeland Management Plan (RMP) - List of the content

<b>1</b>	<b>Ownership status</b>
	Registration records
	The allocated boundaries of rangeland parcels
	The limits and boundaries of the rangeland parcel
	The type of rangeland (Grazing season & Grazing duration)
	The type of the joint exploitation
	Potentiality of resource depletion
	Potentiality of over-grazing
	Non-forage products
<b>2</b>	<b>Rangeland holders status</b>
	Public welfare facilities
	Age and educational structure of the rangeland holders
	The rangeland revenues
<b>3</b>	<b>Natural condition of rangeland</b>
	Extent/Latitude/Longitude of the rangeland parcel
	The type/types of climate
	Freezing periods
	Relative evapotranspiration in various months of a year
	Type of the winds in the area
	Existence of the various types of lands in the rangeland parcel
	The slope of the area
<b>4</b>	<b>Geological information</b>
	Soil structure
	Soil texture
	Water resources
	Potentiality of soil erosion



### Continued table (List of content)

<b>5</b>	<b>Plant vegetation</b>
	The plant geography
	List of the plant vegetation
<b>6</b>	<b>Assessment of the rangeland vegetation</b>
	Rangeland condition
	Rangeland trend
<b>7</b>	<b>Other potentiality of the rangeland</b>
<b>8</b>	<b>Improvement plans</b>
	Vegetation improvement plans
	Plans for management & resource extraction
<b>9</b>	<b>Needed inputs and facilities</b>
	Agricultural machinery and equipment
	Facilities
	Agricultural inputs (Seed, fertilizers, and so on)
	Worker
<b>10</b>	<b>Estimation of costs and revenues</b>
<b>11</b>	<b>Economic interpretation</b>
	Comparison of costs and revenues
	Environmental impact of rangeland conservation

## **Appendix 4**

### The paper sheet of the Grazing License (GL) – List of content

Photo of the holder of the grazing license

Personal identity of the holder

Rangeland geographical location, name, physical boundaries & area of the rangeland parcels

Allowed number of livestock for the holder of the grazing license

Names of other people who hold grazing licenses for the same area

Allowed number of livestock for other holders

Time and period of grazing

## Appendix 5

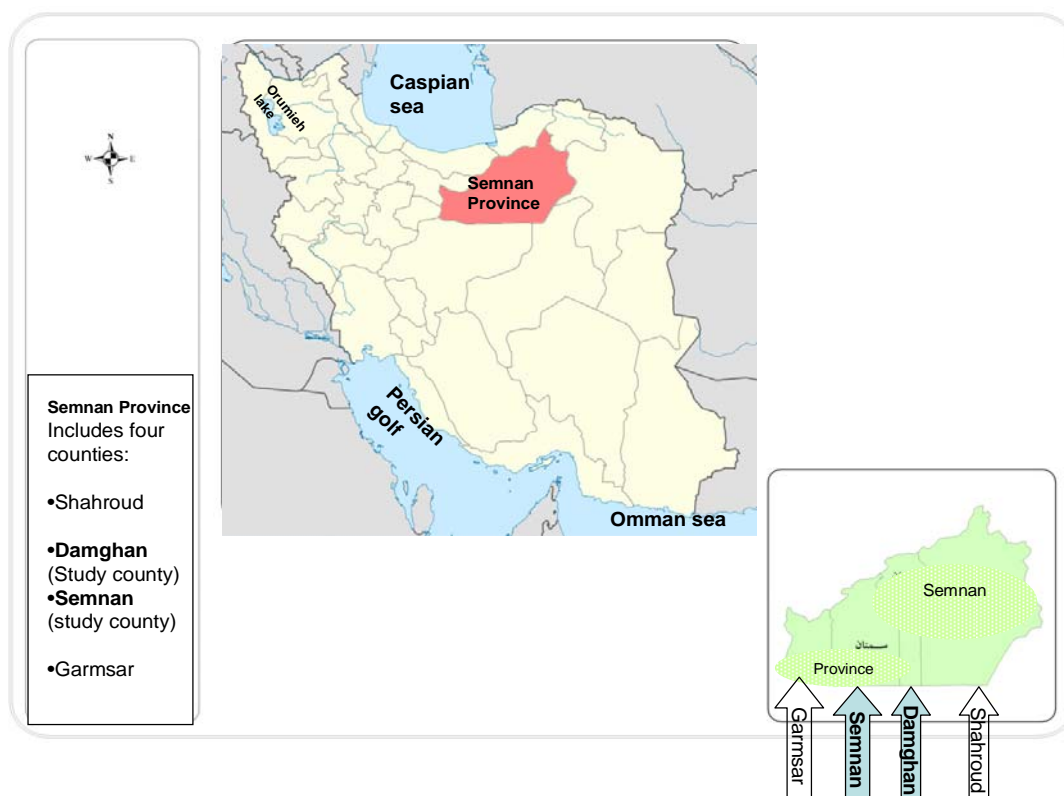
**Table of the coding schemes**

<b>Theme1</b> Flock mobility in a year	Definition	This relates to flock mobility
	<b>The first sub-theme1</b> Mobile members of the household	Which members of a family move
		<b>The second sub-theme 1:</b> The whole family
		<b>The second sub-theme 2:</b> Only male member
		<b>The second sub-theme 3:</b> Only employed shepherd
	<b>The first sub-theme2</b> Grazing time	This relates to the grazing season
		<b>The second sub-theme 1:</b> Summer
		<b>The second sub-theme 2:</b> Winter
		<b>The second sub-theme 3:</b> both summer & winter
<b>Theme2</b> Practical regulations used by the users' groups	Definition	Practical regulations established by the users' groups
	<b>The sub-theme1</b>	Combination of the whole flocks, then division
	<b>The sub-theme2</b>	Entrance at a same time
	<b>The sub-theme3</b>	Exit at the same time
	<b>The sub-theme4</b>	Land protection by an employment
	<b>The sub-theme5</b>	Doing protection programs
	<b>The sub-theme6</b>	Divide the area into individual
	<b>The sub-theme7</b>	Rotating the divided parcel among members
	<b>The sub-theme8</b>	Giving all flocks to only one person
<b>Theme3</b> Reasons to select the livestock husbandry	Definition	The reasons for selecting livestock husbandry
	<b>The first sub-theme1</b> Economic benefits	Livestock husbandry has economic benefits &
		<b>The second sub-theme 1:</b> It is a family job
		<b>The second sub-theme 2:</b> Individual satisfaction
		<b>The second sub-theme 3:</b> We can survive
		<b>The second sub-theme 4:</b> Good economic benefits
	<b>The first sub-theme2</b> Non-economic benefits	Livestock husbandry has no economic benefits, but
		<b>The second sub-theme 1:</b> It is my family job
		<b>The second sub-theme2:</b> The personal satisfaction
		<b>The second sub-theme 3:</b> No other opportunity to work
		<b>The second sub-theme 4:</b> Not losing the land
<b>Theme4</b> Perception about rangeland condition	Definition	This relates to people perception on rangeland condition
	<b>The sub-theme1</b>	Agree
	<b>The sub-theme2</b>	Disagree
	<b>The sub-theme3</b>	Partly agree

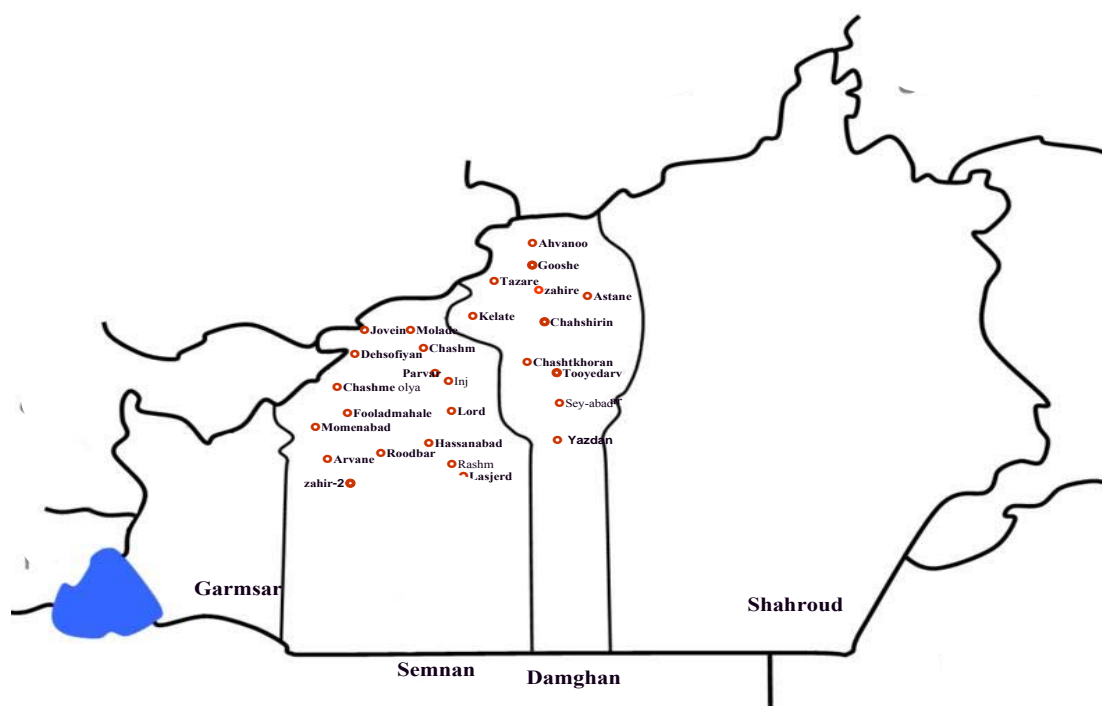
**Continued table (coding scheme)**

<b>Theme5</b> Perception about governmental rules	Definition	General perception upon the governmental rules
	<b>The first sub-theme1</b> Agreement with the governmental rules	Rules are Ok, but
		<b>The second sub-theme 1:</b> Problem of people cooperation
		<b>The second sub-theme 2:</b> Governmental enforcement is weak
		<b>The second sub-theme 3:</b> Privatization system is better
	<b>The first sub-theme2</b> Disagreement with the governmental rules	Disagreement about the governmental rules, because
		<b>The second sub-theme 1:</b> Not having any land for a few months
		<b>The second sub-theme 2:</b> Rules don't fit with our society
		<b>The second sub-theme 3:</b> Reduces our income
		<b>The second sub-theme 4:</b> Not enough support from the rules
		<b>The second sub-theme 5:</b> Not compatible with ecological conditions
		<b>The second sub-theme 6:</b> Causes our cooperation to reduce
		<b>The second sub-theme7:</b> Impossible for us to obey
<b>Theme6</b> Leaving the Livestock husbandry	Definition	Reasons for leaving the livestock husbandry
	<b>The sub-theme1</b>	Physically a very hard job
	<b>The sub-theme2</b>	Having low income
	<b>The sub-theme3</b>	Unfamiliar with the knowledge of livestock husbandry
<b>Theme7</b> Drought management	Definition	Strategies to manage drought
	<b>The sub-theme1</b>	Using other resources
	<b>The sub-theme2</b>	using my agricultural production
<b>Theme8</b> Problems of using rangeland management	Definition	Problems related for using rangeland resources
	<b>The sub-theme1</b>	Drought
	<b>The sub-theme2</b>	Water scarcity
	<b>The sub-theme3</b>	Not having common any land for a few months
	<b>The sub-theme4</b>	Weakness of governmental supports
	<b>The sub-theme5</b>	Small size of livestock defined by the government
	<b>The sub-theme6</b>	Traditional way of raising livestock causes us to be dependent on rangelands
	<b>The sub-theme7</b>	Not having a good position in the society
	<b>The sub-theme8</b>	Low price of meet production during the selling season
	<b>The sub-theme9</b>	The high risk of this job
	<b>The sub-theme10</b>	Common ownership
	<b>The sub-theme11</b>	Limitation because of the state rules
<b>Theme9</b>	Definition	Local suggestions for improving rangeland condition
	<b>The sub-theme1</b>	Too late, rangeland will be destroyed in the near future
	<b>The sub-theme2</b>	Just rainfall can change this situation
	<b>The sub-theme3</b>	Change the governmental rules may be helpful
	<b>The sub-theme4</b>	Providing more information to the users about other rangeland production
	<b>The sub-theme5</b>	State support(job opportunities, financial support, hand-feeding and market improvement)
	<b>The sub-theme6</b>	

## Appendix 7 (The Semnan province)



## Appendix 8 (The study villages)



### Appendix 9 (Population and age structure in the study villages)

Village	Populati on	Female populati on	Male populati on	Populati on 10-29 years old	Populati on 30-64 years old	Populati on more than 64 years old	Number of househol ds
Tazare	214	115	99	75	81	18	52
Sey-abad	509	229	280	154	159	76	148
Yazdan- abad	14	9	5	3	4	7	6
Chashtkhor an	70	41	29	18	25	17	23
Chahshirin	219	112	107	93	75	12	47
Ahvanoo	606	293	313	221	213	66	172
Astane	305	144	161	94	106	52	89
Kelate	2.826	1.444	1.382	1.205	898	193	711
2zahire bala	76	40	36	14	37	19	30
Ghooshe	135	71	64	44	50	24	41
Tooyedarva r	339	172	167	64	117	119	137
Chashm	483	250	233	173	161	67	126
Chashme olya & Sofla	709	352	357	247	232	117	223
Lord	254	119	135	106	83	24	60
Pa ghale roodbar	126	50	76	48	43	4	32
Momenaba d	550	283	267	209	185	67	159
Rashm	327	173	154	129	121	29	78
Arvane	104	57	47	21	46	26	43
2-zahir	102	55	47	14	34	41	47
Hassanaba d	143	69	74	61	35	13	39
Parvar	2.171	1.092	1.079	816	778	179	606
Inj	63	31	32	5	17	34	32
Jovein	26	13	13	5	11	4	11
Lasjerd	1.076	518	558	359	368	139	318
Dehsofiyan	24	14	10	3	13	6	9
Fooladmah ale	1.348	713	635	548	496	125	370
Molade	59	28	31	14	26	16	24

Source: Country census of population (2007)

**Appendix 10** (Educational & occupational structure in the study villages)

Village	Literate female	Literate male	Illiterate female	Literate male	Female students	Male students	Female employee	Male employee
Tazare	80	84	80	84	37	17	3	40
Sey-abad	162	228	162	228	53	101	10	126
Yazdan-abad	5	1	5	1	1	0	0	1
Chashtkhoran	27	19	27	19	5	2	3	13
Chahshirin	73	77	73	77	10	12	3	69
Ahvanoo	211	239	211	239	58	71	4	164
Astane	96	119	96	119	18	23	4	96
Kelate	1.065	1.100	1.065	1.100	359	280	170	807
2zahire bala	20	22	20	22	5	1	2	20
Ghooshe	42	45	42	45	13	16	0	33
Tooyedarvar	80	114	80	114	9	21	4	79
Chashm	166	179	166	179	55	56	7	127
Chashme olya & Sofla	233	276	233	276	66	85	13	203
Lord	90	108	90	108	34	46	3	67
Pa ghale roodbar	43	65	43	65	11	24	2	35
Momenabad	189	197	189	197	58	58	7	147
Rashm	106	105	106	105	40	25	10	79
Arvane	25	33	25	33	1	2	1	24
2-zahir	26	38	26	38	0	3	2	23
Hassanabad	40	54	40	54	10	14	1	38
Parvar	820	856	820	856	226	195	29	567
Inj	7	20	7	20	1	5	1	24
Jovein	5	9	5	9	0	1	0	12
Lasjerd	309	416	309	416	108	123	6	270
Dehsofiyan	11	9	11	9	2	0	0	7
Fooladmahale	466	437	466	437	172	139	34	340
Molade	15	17	15	17	0	1	0	20

Source: Country census of population (2007)



**Appendix 11** (Socio-economic characteristics of the study villages)

Village	Number of residence buildings	Working or studying at the same village	Living in other city	Living in other village
Tazare	52	29	55	4
Sey-abad	148	179	70	8
Yazdan-abad	6	1	1	0
Chashtkhoran	23	11	7	3
Chahshirin	47	76	1	2
Ahvanoo	172	157	85	12
Astane	89	103	20	2
Kelate	711	1.007	105	272
2zahire bala	30	21	5	1
Ghooshe	41	29	18	6
Tooyedarvar	137	79	12	6
Chashm	126	173	49	0
Chashme olya & Sofla	223	241	79	8
Lord	60	56	75	0
Pa ghale roodbar	32	28	37	0
Momenabad	159	151	63	24
Rashm	78	106	6	22
Arvane	43	22	4	0
2-zahir	47	20	3	5
Hassanabad	39	23	25	2
Parvar	606	489	342	61
Inj	32	24	6	0
Jovein	11	12	1	0
Lasjerd	318	272	144	38
Dehsofiyan	9	6	3	0
Fooladmahale	370	584	22	0
Molade	24	20	0	0

Source: Country census of population (2007)

**Appendix 12** (Extent of residence buildings in the study villages of the study villages)

Village	Less than 50	51-75	76-80	81-100	101-150	151-200	201-300	301-500	More than 500
Tazare	4	16	8	7	10	1	1	0	0
Sey-abad	24	42	13	16	44	6	2	1	0
Yazdan-abad	2	0	1	1	2	0	0	0	0
Chashtkhoran	4	3	6	8	2	0	0	0	0
Chahshirin	18	6	3	11	6	1	1	0	0
Ahvanoo	23	38	16	49	24	3	0	0	0
Astane	7	15	22	16	21	4	1	0	0
Kelate	60	62	43	122	277	56	24	1	2
2zahire bala	5	14	2	4	4	1	0	0	0
Ghooshe	7	16	5	7	4	0	2	0	0
Tooyedarvar	24	57	16	17	14	6	2	0	0
Chashm	15	23	26	30	23	3	0	0	0
Chashme olya & Sofla	17	83	49	37	22	4	2	0	0
Lord	1	16	10	14	8	5	2	3	0
Pa ghale roodbar	1	8	2	5	2	3	1	0	0
Momenabad	10	14	9	18	54	36	14	0	0
Rashm	28	21	9	10	6	3	0	0	0
Arvane	5	3	3	8	14	7	1	2	0
2-zahir	19	8	4	12	4	0	0	0	0
Hassanabad	21	5	1	1	2	0	0	0	0
Parvar	34	61	40	93	242	74	21	1	0
Inj	1	18	13	0	0	0	0	0	0
Jovein	0	4	4	1	0	0	0	0	0
Lasjerd	49	81	25	60	63	11	8	2	0
Dehsofiyan	1	1	0	2	4	1	0	0	0
Fooladmahale	6	44	66	112	93	15	4	7	7
Molade	2	5	2	4	6	0	2	0	1

Source: Country census of population (2007)

### Appendix13 (Regional condition of the study villages)

City	Town	Village	Natural condition <sup>73</sup>	Type of the road <sup>74</sup>	Type of habitation <sup>75</sup>	Entrance month	Exit month
Damghan	Dman Kooh	Tazare	2	1	1	0	0
Damghan	Ghahab Sar Sar	Sey-abad	1	1	1	0	0
Damghan	Ghahab Sar Sar	Yazdan-abad	1	3	1	0	0
Damghan	Hoome	Chashtkhoran	1	1	1	0	0
Damghan	Kelate Sharghi	Chahshirin	1	2	1	0	0
Damghan	Roodbar	Ahvanoo	2	1	1	0	0
Damghan	Roodbar	Astane	2	1	1	0	0
Damghan	Roodbar	Kelate	2	1	1	0	0
Damghan	Tooye darvar	2zahire bala	2	1	1	0	0
Damghan	Tooye darvar	Ghooshe	1	1	1	0	0
Damghan	Tooye darvar	Tooyedarvar	2	1	1	0	0
Semnan	Chashm	Chashm	2	1	1	0	0
Semnan	Chashm	Chashme olya & Sofla	2	1	1	0	0
Semnan	Chashm	Lord	5	1	1	0	0
Semnan	Chashm	Pa ghale roodbar	5	1	1	0	0
Semnan	Daman kooh	Momenabad	1	1	1	0	0
Semnan	Ghahab Rastagh	Rashm	2	3	1	0	0
Semnan	Hafdar	Arvane	2	1	1	0	0
Semnan	Hoome	2-zahir	1	1	1	0	0
Semnan	Hoome	Hassanabad	1	1	1	0	0
Semnan	Kharghan	Parvar	1	2	1	0	0
Semnan	Lasgerd	Inj	2	3	1	0	0
Semnan	Lasgerd	Jovein	2	3	2	1 (March)	7 (September)
Semnan	Lasgerd	Lasjerd	1	1	1	0	0
Semnan	Poosht kooh	Dehsofiyan	2	1	1	0	0
Semnan	Poosht kooh	Fooladmahale	1	1	1	0	0
Semnan	Poosht kooh	Molade	2	3	1	0	0

Source: Country census of population (2007)

<sup>73</sup> (2) was used for mountainous area (3) for flat area (4) for valley.

<sup>74</sup> (1) was used for asphalt area (2) for stony road and (3) for dusty road.

<sup>75</sup> (1) was used for permanent habitation and (2) for seasonal habitation.

#### Appendix 14 (Shop facilities of the study villages)

Village	Shops location(1) <sup>76</sup>	Shops location(2) <sup>77</sup>	Shops location(3) <sup>78</sup>	Name of the first city	Name of the second city
Tazare	1	4	5	1540	1547
Sey-abad	1	3	5	1540	2263
Yazdan-abad	2	0	5	1540	0000
Chashtkhoran	2	0	5	1540	0000
Chahshirin	2	0	5	2162	2641
Ahvanoo	2	0	5	1540	0000
Astane	1	4	5	1540	1169
Kelate	1	3	5	1540	1547
2zahire bala	2	0	5	1540	0000
Ghooshe	2	0	5	1540	0000
Tooyedarvar	2	0	5	1540	1542
Chashm	1	4	5	1543	1542
Chashme olya & Sofla	2	0	5	1540	0000
Lord	2	0	5	1543	1171
Pa ghale roodbar	2	0	5	1543	1171
Momenabad	1	3	5	1540	1547
Rashm	1	3	5	1540	0000
Arvane	2	0	5	1542	1154
2-zahir	1	3	5	1542	1547
Hassanabad	2	0	5	1542	0000
Parvar	1	3	6	0000	0000
Inj	1	4	5	1541	1542
Jovein	2	0	5	1541	0000
Lasjerd	1	3	5	1541	1542
Dehsofiyan	2	0	5	1543	1544
Fooladmahale	1	3	5	1542	1540
Molade	1	3	5	1542	1543

Source: Country census of population (2007)

<sup>76</sup> (1) was used if the study village has shops for necessary tools and (2) if the study has no shop for necessary tools.

<sup>77</sup> (3) was used if other villages come for buying necessary tools (4) if any village does not come for buying necessary tools.

<sup>78</sup> (5) was used if people from the study village go to the close cities for buying necessary tools (6) if people do not go.

### Appendix 15 (Education facilities in the study villages)

Village	Existence of elementary school	Existence of guidance school for female	Existence of guidance school for male	Existence of guidance school for mixed-male & female	Existence of high school for male	Existence of high school for female	Existence of public library	Existence of sport hall
Tazare	0	0	0	0	0	0	1	0
Sey-abad	1	0	0	0	1	0	1	0
Yazdan-abad	0	0	0	0	0	0	0	0
Chashtkhoran	1	0	0	0	0	0	0	0
Chahshirin	1	0	0	0	0	0	0	0
Ahvanoo	1	0	0	0	0	0	0	1
Astane	1	0	0	0	0	0	0	0
Kelate	1	1	1	0	1	1	1	1
2zahire bala	1	0	0	0	0	0	0	0
Ghooshe	1	0	0	0	0	0	0	0
Tooyedarvar	1	0	0	1	0	0	0	0
Chashm	1	1	1	1	0	0	1	0
Chashmeh olya & Sofla	1	1	1	0	0	0	1	1
Lord	0	0	0	0	0	0	0	0
Pa ghale roodbar	0	0	0	0	0	0	0	0
Momenabad	1	0	0	0	0	0	1	0
Rashm	1	0	1	0	0	0	0	0
Arvane	1	0	0	0	0	0	0	0
2-zahir	0	0	0	0	0	0	1	0
Hassanabad	0	0	0	0	0	0	1	0
Parvar	1	1	1	0	0	1	0	0
Inj	0	0	0	0	0	0	0	0
Jovein	0	0	0	0	0	0	0	0
Lasjerd	1	1	1	0	1	0	1	0
Dehsofiyan	1	0	0	0	0	0	0	0
Fooladmahale	1	1	1	0	1	1	1	1
Molade	0	0	0	0	0	0	0	0

Source: Country census of population (2007)

**Appendix 16** (Religious places and governmental services in the study villages)

Village	Religious places				Governmental services		
	Mosque	Imam's grave	Other Muslim's places	Holly places for other religious	Village council	Agriculture-Jihad centre	Cooperative village organization
Tazare	1	1	1	0	1	0	1
Sey-abad	1	1	0	0	1	0	1
Yazdan-abad	1	0	0	0	0	0	0
Chashtkhoran	1	0	0	0	1	0	1
Chahshirin	0	0	0	0	1	1	0
Ahvanoo	1	1	1	0	1	0	1
Astane	1	0	0	0	1	0	1
Kelate	1	1	0	0	1	1	1
2zahire bala	1	1	1	0	1	0	0
Ghooshe	1	0	1	0	1	0	1
Tooyedarvar	1	1	1	0	1	0	1
Chashm	1	1	1	0	1	1	1
Chashme olya & Sofla	1	1	0	0	1	0	1
Lord	0	0	1	0	1	0	1
Pa ghale roodbar	0	0	1	0	0	0	0
Momenabad	1	0	1	0	1	0	1
Rashm	1	1	0	0	1	0	1
Arvane	1	1	1	0	1	0	1
2-zahir	1	0	0	0	1	0	0
Hassanabad	1	0	0	0	1	0	0
Parvar	1	0	1	0	1	0	1
Inj	1	1	0	0	1	0	1
Jovein	1	0	0	0	0	0	0
Lasjerd	1	1	0	0	1	0	1
Dehsofiyan	1	1	0	0	1	0	1
Fooladmahale	1	1	1	1	1	1	1
Molade	1	1	1	0	1	0	1

Source: Country census of population (2007)

### Appendix 17 (Energy infrastructure in the study villages)

Village	Electrical power network	Natural gas pipelines	Drinking water supply	Water purification
Tazare	1	0	1	1
Sey-abad	1	1	1	0
Yazdan-abad	1	0	1	0
Chashtkhoran	1	1	1	0
Chahshirin	1	0	1	1
Ahvanoo	1	0	1	0
Astane	1	0	1	0
Kelate	1	1	1	0
2zahire bala	1	0	1	0
Ghooshe	1	0	1	0
Tooyedarvar	1	0	1	0
Chashm	1	0	1	1
Chashme olya & Sofla	1	0	1	0
Lord	1	0	1	0
Pa ghale roodbar	1	0	1	0
Momenabad	1	0	1	1
Rashm	1	0	1	1
Arvane	1	0	1	0
2-zahir	1	0	1	0
Hassanabad	1	0	1	0
Parvar	1	1	1	0
Inj	1	0	1	1
Jovein	1	0	1	0
Lasjerd	1	1	1	1
Dehsofiyan	1	0	1	1
Fooladmahale	1	0	1	1
Molade	1	0	1	1

Source: Country census of population (2007)

### Appendix 18 (Health infrastructure in the study villages)

Village	Public bath-house	Health centre	Pharmacy	Consulting healthy house	Existence of medical doctor	Dental centre	Veterinary surgeon	Veterinary technician
Tazare	1	0	0	1	1	0	0	0
Sey-abad	1	0	0	1	1	0	0	0
Yazdan-abad	1	0	0	0	0	0	0	0
Chashtkhoran	1	0	0	0	0	0	0	0
Chahshirin	0	0	0	0	0	0	0	0
Ahvanoo	0	0	0	1	1	0	0	0
Astane	1	0	1	1	0	0	0	0
Kelate	1	1	1	1	1	0	0	0
2zahire bala	1	1	0	1	1	0	0	0
Ghooshe	1	0	0	0	0	0	0	0
Tooyedarvar	1	0	0	1	0	0	0	0
Chashm	1	1	0	1	0	0	0	0
Chashme olya & Sofla	1	1	0	1	1	0	0	0
Lord	0	0	0	0	0	0	0	0
Pa ghale roodbar	0	0	0	0	0	0	0	0
Momenabad	1	0	0	1	1	0	0	0
Rashm	0	0	0	1	1	0	0	0
Arvane	1	1	0	1	0	0	0	0
2-zahir	1	0	0	0	1	0	1	1
Hassanabad	1	0	0	0	0	0	0	0
Parvar	1	0	0	1	1	0	0	1
Inj	0	0	0	1	0	0	0	0
Jovein	0	0	0	0	0	0	0	0
Lasjerd	1	0	1	1	1	0	0	0
Dehsofiyan	1	1	0	1	1	0	0	0
Fooladmahale	1	1	1	1	1	1	0	1
Molade	1	1	0	0	1	0	0	0

Source: Country census of population (2007)



**Appendix 19** (Transportation infrastructure in the study villages)

Village	Post box	Post office	Phone centres	Accessibility to the Internet	Accessibility to public transportation	Accessibility to magazines and newspaper
Tazare	1	1	1	0	1	0
Sey-abad	1	1	1	1	1	0
Yazdan-abad	0	0	0	0	0	0
Chashtkhoran	1	1	1	0	0	0
Chahshirin	0	0	1	0	0	0
Ahvanoo	1	1	1	1	1	0
Astane	1	1	1	1	0	0
Kelate	1	1	1	1	1	1
2zahire bala	1	1	1	0	0	0
Ghooshe	1	1	1	0	0	0
Tooyedarvar	1	1	1	0	0	0
Chashm	1	1	1	0	1	0
Chashme olya & Sofla	1	1	1	1	0	0
Lord	0	0	1	0	1	0
Pa ghale roodbar	0	0	0	0	1	0
Momenabad	1	1	1	0	1	0
Rashm	1	1	1	1	1	0
Arvane	1	0	1	0	0	0
2-zahir	0	0	1	0	1	0
Hassanabad	1	0	1	0	0	0
Parvar	1	1	1	0	1	0
Inj	1	1	1	0	0	0
Jovein	0	0	1	0	0	0
Lasjerd	1	1	1	1	1	1
Dehsofiyan	1	0	1	0	0	0
Fooladmahale	1	1	1	1	1	0
Molade	0	0	1	0	0	0

Source: Country census of population (2007)