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## The Agdal system or the art of managing spatio-temporality of forage resources and risks in the high atlas mountains of Morocco

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**Key words :** Agdal, sylvopastoral management, common property rules, High Atlas, Morocco

**Introduction** In the Moroccan mountains, the Berber term *Agdal* means a sylvopastoral area where access and uses are submitted to collective rules imposed by a traditional community. It usually refers to a judicious temporary seasonal resting area with the agreement of the whole tribal assembly (Jmaa), in order to improve the natural resources growing *in situ*. However, this practice takes a wide variety of forms depending on the available natural resources and local cosmogony involved. Mainly, the *Agdal* system constitutes one of the tools for managing diversified, but highly heterogeneous forage resources. Based on a five year research program studying the *Agdals* functioning, we aim to document the roles of these management types on the livestock systems in the High Atlas Mountains.

**Materials and methods** The study area (Aït Bouguemez valley) is located in the Central High Atlas, a semi-arid mountain area with elevation ranging from 1400 to 3000 masl, and annual precipitation between 400 to 600 mm. Surveys concerning livestock management systems were performed with 63 pastoral units in order to characterise their flock movements and their dependency upon natural pastoral resources. Seasonal small stock forage schedules were evaluated and a typology built by mean of multivariate analyses.

**Results and discussion** We propose a typology of small ruminant farming systems based on livestock mobility, reared ovine races and involved cultivated areas. For the five identified types, we built up small stock forage schedules (Table 1). These illustrate differences in the use of private and collective forage resources, depending on constraints and opportunities confronting each type. Globally speaking, the *Agdals* have three critical functions in relation to the development of extensive livestock farming systems:

- They constitute a standing forage reserve, in order to cope with critical climatic events which are common in the region. For example, in the case of forest *Agdals* surrounding villages, leaf fodder represents the main part of livestock diet in the event of snow fall. This particular forage resource is in this case an easily available "life insurance" to save livestock from death.
- *Agdals*, due to their diversity and location at diverse altitudes, constitute an efficient interconnected network for managing spatio-temporality of forage resources. They therefore constitute an interesting management tool in order to ensure a certain continuity of forage production year-round, and to preserve forage resources in the long-term, mobilising detailed local knowledge.
- Finally, thanks to a precise identification of right-owners and to concerted flexible rules, *Agdals* constitute a stabilising element for a certain land use security in a context of high competition for pastoral and forest resources.

**Table 1** Importance of diversified forage resources in small stock feeding systems in the Central High Atlas.

	Compulsory sedentarianism		Possible Transhumance (depending on the year)		Compulsory Transhumance
	Type 1	Type 2	Type 3	Type 4	Type 5
Cultivated forages produced on farm	-to 0	+++	++	-	-
Cultivated forages from outside the farm	++ (donations)	++	-	+	+
Sylvopastoral areas located near village	+++	++	++	+	+
Tree forages (including those from forest Agdals)	+++	+	++	0 or +	0
Pastoral Agdals	0	0	++	++	++
Inter-tribal pastoral area (Izoughar)	0	-	++	++	++
Rangelands outside the valley territory	0	0	++ or 0	+++ or 0	+++