LAND USE PLAN

Houay Namhi Sub-watershed, Nammang Watershed
Thaphabath, Bolikhamsai, Lao PDR.







Land Development Department
Ministry of Agriculture and Cooperatives

LAND USE PLAN

Houay Namhi Sub-watershed

Nam Mang Watershed

Thaphabath District, Bolikhamsai Province

Lao People's Democratic Republic

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Ministry of Agriculture and Cooperatives

~2018~

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INTRODUCTION

Implementation of the project under the Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS) is the cooperation between the five-member countries of Kingdom of Cambodia, Republic of the Union of Myanmar, Socialist Republic of Vietnam, Lao People's Democratic Republic and Kingdom of Thailand.

Land Development Department has implemented the ACMECS project since 2004 until the present based on the knowledge on land development, training and practice on soil survey, soil classification and soil map, land evaluation and land use planning process, soil improvement management and preparation of land development network, establishment of learning center and technology transfer.

For integrated agricultural development program of Kingdom of Thailand and Lao People's Democratic Republic under the ACMECS framework, the objective is to enhance the competitiveness and economic development of the country by sharing the benefits under the concept of joint production and joint marketing promotion.

OBJECTIVES

1) To prepare land use plan in Houay Namhi Sub-watershed, Nammang Watershed according to land potential and resources currently available.

2) To possibly increase the efficiency of production and sustainable use of resources in the watershed.

PROCEDURES

1) Data gathering: Primary data collection through field survey and secondary data collection such as the national forest map.

2) Importing and analyzing spatial data using Geographic Information System (GIS).

Land Unit: overlaying data between land unit and land use data. The land unit was established based on soil properties and used for qualitative land evaluation and land use planning.

Land Use: interpreting data from satellite image and field survey. It is used for the preparation of land unit and for land use planning.

Qualitative Land Evaluation: Using soil properties data on crop requirements. It is used for evaluating land use plan.

Land Use Planning: overlaying land unit, land use, land suitability and national forest, and then preparing the land use plan.

RESULTS

GENERAL INFORMATION

The Houay Namhi Sub-watershed is part of the Nam Mang Watershed. Located between the latitudes at 18° 14′ 11.9″ to 18° 22′ 27.5″ N and the longitude 103° 00′ 28.0″ to 103° 17′ 57.0″ E. Most areas are in Thaphabath District (ເມືອງທ່າພະບາດ) Bolikhamsai Province (ແຂວງບໍລິຄຳໄຊ) Lao People's Democratic Republic. The area is 21,697 hectares, or 216.97 square kilometers, or 135,606.25 rai. The territory is as follows. (Figure 1)

North contact with Xaisomboun District (ເມືອງໄຊສົມບູນ) Vientiane Province (ແຂວງວຽງຈັນ)

South contact with Mayparkngum District (ເມືອງໃໝ່ປາກງຶ່ມ) Vientiane Capital (ນະຄອນຫຼວງວຽງຈັນ)

East contact with Bolikhanh District (ເມືອງບໍລິຄັນ), Pakxan District (ເມືອງປາກຊັນ) Bolikhamsai Province and the Mekong River

West contact with Thoulakhom District (ເມືອງທຸລະຄົມ) Vientiane Province

The terrain of Houay Namhi Sub- watershed, Nam Mang Watershed is mountainous in the west. It locates in the national forest and slopes down to the east until the Mekong River. The main river is the Houay Namhi, which flows from the southwest to the northeast and then flows into the Nam Mang River. There is also a middle swamp area on the east side of the Sub-watershed.

LAND UNIT

Land unit analysis was prepared for evaluating land suitability to grow economic crops. Based on the analysis, there were 38 land units. Description of each land unit is shown in Table 1 and Figure 2.

LAND USE

Analysis of land use in 2018 based on satellite imagery interpretation and field survey showed that land uses can be divided into 5 groups. (Table 2 and Figure 3)

1) Urban and built-up land (U) area is 505 hectare (2.32%)
2) Agricultural land (A) area is 5,053 hectare (23.28%)
3) Forest land (F) area is 12,855 hectare (59.25%)
4) Water body (W) area is 1,361 hectare (6.27%)
5) Miscellaneous land (M) area is 1,923 hectare (8.88%)

QUALITATIVE LAND EVALUATION

There are 5 land utilization types: paddy, corn, rubber, oil palm and mango. Suitability evaluation was made by matching land quality of each land unit and land use requirements as growth factors for each crop. The land suitability for planting crops is as follows. (Table 3 and Figure 4-8)

Table 1 Land unit in Houay Namhi Sub-watershed, Nammang Watershed, Thaphabath, Bolikhamsai, Lao PDR, 2018

Land unit	Texture		Drainage	Fertility	CEC	BS	Depth	Slope	pH		Area	
	Topsoil	Subsoil			(cmol/kg)	(%)	(cm)	(%)	topsoil	subsoil	Hectare	%
NH1-lA	sil-l	sil-cl	mw	low	<10	<35	>150	0-2	5.5-7.0	5.5-7.0	794	3.66
NH1-lAM3	sil-l	sil-cl	spd	low	<10	<35	>150	0-2	5.5-7.0	5.5-7.0	84	0.39
NH1-gm-silA	sil-l	sil-sicl	pd	low	<10	<35	>150	0-2	5.5-7.0	5.0-7.0	515	2.37
NH1-gm-silAM3	sil-l	sil-sicl	vpd	low	<10	<35	>150	0-2	5.5-7.0	5.0-7.0	364	1.68
NH2-sicA	sicl-cl	sic-c	pd	low	10-20	<35	>150	0-2	4.5-6.0	4.5-5.0	497	2.29
NH2-sicAM2	sicl-cl	sic-c	spd	low	10-20	<35	>150	0-2	4.5-6.0	4.5-5.0	6	0.03
NH3-lA	scl-l	l-sicl	spd	low	10-20	<35	>150	0-2	5.5-6.5	4.5-5.0	1,033	4.76
NH3-lAM2	scl-l	l-sicl	mw	low	10-20	<35	>150	0-2	5.5-6.5	4.5-5.0	10	0.05
NH4-lA	l	l-cl	spd	medium	10-20	35-75	>150	0-2	5.5-6.5	5.5-7.0	209	0.96
NH4-lAM2	l	l-cl	mw	medium	10-20	35-75	>150	0-2	5.5-6.5	5.5-7.0	2	0.01
NH5-sclA	scl-l	c	spd	low	10-20	<75	>150	0-2	5.0-6.5	4.5-5.0	77	0.35
NH5-sclAM2	scl-l	c	mw	low	10-20	<75	>150	0-2	5.0-6.5	4.5-5.0	15	0.07
NH6-slB	sl-scl	scl	wd	low	<10	<75	>150	2-5	5.5-6.5	4.5-5.0	2,055	9.47
NH6-slBM3	sl-scl	scl	mw	low	<10	<75	>150	2-5	5.5-6.5	4.5-5.0	125	0.58
NH6-slB/d3c	sl-scl	scl-vgscl	wd	low	<10	<75	50-100	2-5	5.5-6.5	4.5-5.0	1,870	8.62
NH6-slB/d3cM3	sl-scl	scl-vgscl	mw	low	<10	<75	50-100	2-5	5.5-6.5	4.5-5.0	32	0.15
NH6-col-slB	sl-ls	sl-scl	wd	low	<10	<75	>150	2-5	5.5-6.5	4.5-5.0	199	0.92
NH6-col-slBM3	sl-ls	sl-scl	mw	low	<10	<75	>150	2-5	5.5-6.5	4.5-5.0	2	0.01
NH7-slA	sl-ls	scl-cl	spd	low	<10	<35	>150	0-2	5.5-6.5	4.5-5.0	406	1.87
NH7-slAM3	sl-ls	scl-cl	pd	low	<10	<35	>150	0-2	5.5-6.5	4.5-5.0	28	0.13

Table 1 (Continued)

Land unit	Texture		Drainage	Fertility	CEC	BS	Depth	Slope	pH		Area	
	Topsoil	Subsoil			(cmol/kg)	(%)	(cm)	(%)	Topsoil	Subsoil	hectare	%
NH8-vgclB	sgcl-vgcl	gc-vgc	mw	low	<10	<35	25-50	2-5	5.0-6.5	4.5-5.5	83	0.38
NH8-vgclBM3	sgcl-vgcl	gc-vgc	spd	low	<10	<35	25-50	2-5	5.0-6.5	4.5-5.5	5	0.02
NH9-slB	ls-sl	vgsl	wd	low	<10	<35	25-50	2-5	5.5-6.5	4.5-5.0	1,595	7.35
NH9-slBM3	ls-sl	vgsl	mw	low	<10	<35	25-50	2-5	5.5-6.5	4.5-5.0	4	0.02
NH9-slC	ls-sl	vgsl	wd	low	<10	<35	25-50	5-12	5.5-6.5	4.5-5.0	778	3.59
NH10-slB	sl-ls	sl-scl	wd	low	<10	<35	>150	2-5	5.0-6.5	4.5-5.5	953	4.39
NH10-slBM2	sl-ls	sl-scl	ex	low	<10	<35	>150	2-5	5.0-6.5	4.5-5.5	393	1.81
NH10-gm-slA	sl-ls	sl-scl	spd	low	<10	<35	>150	0-2	5.0-6.5	4.5-5.5	137	0.63
NH10-gm-slAM2	sl-ls	sl-scl	mw	low	<10	<35	>150	0-2	5.0-6.5	4.5-5.5	68	0.31
NH11-silB	cl-sicl	c	wd	medium	10-20	<75	50-100	2-5	6.0-7.0	5.5-6.5	675	3.11
NH11-silBM3	cl-sicl	c	mw	medium	10-20	<75	50-100	2-5	6.0-7.0	5.5-6.5	41	0.19
NH12-lA	l-sl	l-scl	mw	low	<10	35-75	>150	0-2	5.5-6.5	5.5-6.5	359	1.65
NH12-lAM2	l-sl	l-scl	wd	low	<10	35-75	>150	0-2	5.5-6.5	5.5-6.5	160	0.74
NH12-spd-lA	l-sil	l-sil	spd	low	<10	<35	>150	0-2	5.5-6.5	5.5-6.5	434	2.00
NH12-spd-lAM2	l-sil	l-sil	mw	low	<10	<35	>150	0-2	5.5-6.5	5.5-6.5	20	0.09
SC	-	-	-	-	-	-	-	>35	-	-	5,803	26.75
U	-	-	-	-	-	-	-	-	-	-	505	2.33
W	-	-	-	-	-	-	-	-	-	-	1,361	6.27
					Total						**21,697**	**100.00**

Note:

	soil texture
ls	loamy sand
sl	sandy loam
l	loam
sil	silt loam
cl	clay loam
scl	sandy clay loam
sicl	silty clay loam
c	clay
sic	silty clay
vgsl	very gravelly sandy loam
sgcl	slightly gravelly clay loam
vgcl	very gravelly clay loam
vgscl	very gravelly sandy clay loam
gc	gravelly clay
vgc	very gravelly clay

	drainage class
vpd	very poorly drained
pd	poorly drained
spd	somewhat poorly drained
mw	moderately well drained
wd	well drained
ex	excessively drained
	CEC (Cation Exchange Capacity)
low	<10 cmol/kg
medium	10-20 cmol/kg
	BS (Base Saturation)
low	<35 %
medium	35-75 %
	soil depth
very deep	>150 cm
deep	100-150 cm
moderately deep	50-100 cm
shallow	25-50 cm

	slope class
A	level to nearly level or 0-2 %
B	gently undulating or 2-5 %
C	undulating or 5-12 %
	other
col	coarse loamy textural group
gm	gray mottles found within 75 cm
d3c	concretion of Fe/Mn found within 50-100 cm
M2	managed land by ridging in lowland
M3	managed land by bunded in upland
SC	Slope Complex
U	Urban area
W	Water body

Table 2 Land use in Houay Namhi Sub-watershed, Nammang Watershed, Thaphabath, Bolikhamsai, Lao PDR, 2018

Land use code	Land use classification	Area	
		Hectare	%
U	***Urban and built-up land***	***505***	***2.32***
U201	Village	386	1.78
U301	Institutional land	55	0.25
U405	Road	37	0.17
U502	Factory	5	0.02
U503	Agricultural product trading center	8	0.04
U601	Recreation area	5	0.02
U602	Resort, Hotel, Guesthouse	8	0.04
U605	Gasoline Station	1	-
A	***Agricultural land***	***5,053***	***23.28***
A1	**Paddy field**	**1,532**	**7.06**
A100	Abandoned paddy field	89	0.41
A101	Active paddy field	1,443	6.65
A2	**Field crop**	**443**	**2.04**
A200	Abandoned field crop	75	0.35
A201	Mixed field crop	335	1.54
A202	Corn	2	0.01
A205	Pineapple	1	-
A216	Upland rice	30	0.14
A3	**Perennial crop**	**2,862**	**13.19**
A301	Mixed perennial	42	0.19
A302	Rubber	2,690	12.40
A303	Oil palm	49	0.23
A304	Eucalyptus	70	0.32
A305	Teak	9	0.04
A322	Eagle wood	2	0.01

Table 2 (Continued)

Land use code	Land use classification	Area	
		Hectare	%
A4	**Orchard**	**50**	**0.22**
A401	Mixed orchard	46	0.21
A407	Mango	2	0.01
A412	Tamarind	1	-
A422	Lime	1	-
A6	**Shifting cultivation**	**130**	**0.60**
A600	Bush fallow	60	0.28
A616	Upland rice (Shifting cultivation)	70	0.32
A7	**Pasture and farm house**	**36**	**0.17**
A701	Pasture	15	0.07
A702	Cattle farm house	21	0.10
F	***Forest land***	***12,855***	***59.25***
F200	Disturbed deciduous forest	1,275	5.88
F201	Dense deciduous forest	11,580	53.37
W	**Water body**	**1,361**	**6.27**
W101	River, Canal	1,235	5.69
W102	Lake, Lagoon	94	0.43
W201	Reservoir	19	0.09
W202	Farm pond	13	0.06
M	**Miscellaneous land**	**1,923**	**8.88**
M101	Grass	8	0.04
M102	Shrub land	825	3.80
M201	Marsh and Swamp	664	3.06
M201+A101	Marsh and Swamp + Active paddy field	357	1.65

Table 2 (Continued)

Land use code	Land use classification	Area	
		Hectare	%
M300	Abandoned mine, Pit	10	0.05
M304	Soil pit	32	0.15
M401	Material dump	2	0.01
M403	Rock out crop	21	0.10
M405	Landfill	4	0.02
	Total	**21,697**	**100.00**

Table 3 Land suitability in Houay Namhi Sub-watershed, Nammang Watershed, Thaphabath, Bolikhamsai, Lao PDR, 2018

Land unit	Land utilization type				
	Paddy	Corn	Rubber	Oil palm	Mango
NH1-lA	S2ons	S2ons	S2ons	S2ns	S2ns
NH1-lAM3	S2ns	S3o	S3o	S2ons	S3o
NH1-gm-silA	S2ns	N	N	S3o	N
NH1-gm-silAM3	S2ns	N	N	N	N
NH2-sicA	S2ns	N	N	S3o	N
NH2-sicAM2	S2ns	S3o	S3o	S2ons	S3o
NH3-lA	S2ns	S3o	S3o	S2ons	S3o
NH3-lAM2	S2ons	S2ons	S2ons	S2ns	S2ns
NH4-lA	S1	S3o	S3o	S2o	S3o
NH4-lAM2	S2o	S2o	S2o	S1	S2s
NH5-sclA	S2s	S3o	S3o	S2os	S3o
NH5-sclAM2	S2os	S2os	S2os	S2s	S2s
NH6-slB	S3o	S2ns	S2ns	S2ns	S2ns
NH6-slBM3	S2ewons	S2ons	S2ons	S2ns	S2ns
NH6-slB/d3c	S3o	S2rns	S2rns	S2ns	S2ns
NH6-slB/d3cM3	S2ewons	S2rons	S2rons	S2ns	S2ns
NH6-col-slB	S3o	S2ns	S2ns	S2ns	S2ns
NH6-col-slBM3	S2ewons	S2ons	S2ons	S2ns	S2ns

Table 3 (Continued)

Land unit	Land utilization type				
	Paddy	Corn	Rubber	Oil palm	Mango
NH7-slA	S2ns	S3o	S3o	S2ons	S3o
NH7-slAM3	S2ns	N	N	S3o	N
NH8-vgclB	S2ewrons	S3r	S2rons	N	N
NH8-vgclBM3	S2ewrns	S3r	S2rns	N	N
NH9-slB	S3o	S3r	S2rns	N	N
NH9-slBM3	S2ewrons	S3r	S2rons	N	N
NH9-slC	S3o	S3r	S2rns	N	N
NH10-slB	S3o	S2ns	S2ns	S2ns	S2ns
NH10-slBM2	N	S2ns	S2ns	S3o	S2ns
NH10-gm-slA	S2ns	S2ns	S2ns	S2ns	S2ns
NH10-gm-slAM2	S2ons	S2ons	S2ons	S2ns	S2ns
NH11-silB	S3o	S2r	S2r	S1	S2s
NH11-silBM3	S2ewo	S2ro	S2ro	S1	S2s
NH12-lA	S2ons	S2ons	S2ons	S2ns	S2ns
NH12-lAM2	S3o	S2ns	S2ns	S2ns	S2ns
NH12-spd-lA	S2ns	S2ns	S2ns	S2ns	S2ns
NH12-spd-lAM2	S2ons	S2ons	S2ons	S2ns	S2ns
SC	N	N	N	N	N

Note:

Land suitability class: S1 - Highly suitable
S2 - Moderately suitable
S3 - Marginally suitable
N - Not suitable

Limitation of land quality: e - Erosion hazard
w - Potential for mechanization
r - Rooting condition
o - Oxygen availability
n - Nutrient retention
s - Nutrient availability

LAND USE PLAN

Analysis of natural resources such as soil and land use, water resource, forest resource, environment and climate as well as policies and strategies associated with the problems and needs of local people in the watersheds. Land use plan was prepared to use the land appropriately and sustainably by adopting sufficiency economy. The land use plan is divided into 5 main zones as follows: (Table 4 and Figure 9)

1. Forest zone

The forest zone has an area of 6,813 hectares (31.40%). This zone is the legal forest (National Forest). The forest zone can be defined in 3 zones as follows.

1.1 Protected forest zone area is 6,602 hectare (30.43%). Currently it is covered with dense deciduous forest.

1.2 Forest rehabilitation zone area is 62 hectare (0.28%). Currently it is described as disturbed deciduous forest.

1.3 Reforestation zone under condition area is 149 hectare (0.69%). Currently there is agriculture in the forest zone.

Development approach:

- Adding of measures to conserve forest
- Establishment of soil and water conservation system
- Setting up reforestation and forest restoration program
- Control of the forest area invasion

2. Agricultural zone

The agricultural zone has an area of 5,255 hectares (24.22%). It is mainly utilized in agriculture. This area is primarily for agricultural development. It is an important area related to the livelihoods of most people in the watershed. The area in this area has both potential areas suitable for economic crops and less suitable areas for agriculture. Farmers cultivate crops for subsistence. The agricultural zone can be defined in 4 zones.

2.1 Irrigation agricultural zone area is 431 hectare (1.99%). This area is supplied with water by pumping from the Mekong River for cultivation. This zone has high potential for production and development in the future.

2.1.1 Paddy field area is 431 hectare (1.99%). Nowadays, there are paddy fields and some double-crop fields.

2.2 Progressive agricultural zone area is 3,873 hectare (17.85%). This area is moderately suitable (S2) for cultivation and currently is used for farming.

2.2.1 Paddy field area is 1,558 hectare (7.18%). Nowadays, there are paddy fields.

2.2.2 Field crop area is 342 hectare (1.58%). The area is mostly mixed field crops.

2.2.3 Orchard area is 45 hectare (0.21%). The area is mostly mixed orchards.

2.2.4 Perennial plant area is 1,928 hectare (8.88%). The area is mostly rubber.

2.3 Accelerated agricultural zone area is 915 hectare (4.22%). This area is marginally suitable (S3) for cultivation and currently farming.

2.3.1 Paddy field area is 52 hectare (0.24%). Nowadays, there are paddy fields.

2.3.2 Field crop area is 74 hectare (0.34%). The area is mostly mixed field crops.

2.3.3 Perennial plant area is 789 hectare (3.64%). The area is mostly rubber.

2.4 Livestock zone area is 36 hectare (0.16%). This area is determined by the condition of the land being used for pasture and livestock.

Development approach:

- Planning of production and managing water appropriately
- Development of irrigation system
- Increase of productivity
- Improvement of soil properties
- Market of agricultural products
- Promote of livestock
- Establishment of soil and water conservation system

3. Community zone area is 557 hectare (2.57%). This area is determined by the condition of the land used for urban and built-up land.

Development approach:

- Preparation of urban planning
- Development of infrastructure
- Resolving waste and sewage problems

4. Water resources zone area is 1,361 hectare (6.27%). This area is determined by the condition of the land used for water body.

4.1 Natural water body zone area is 1,329 hectare (6.12%).

4.2 Artificial water body zone area is 32 hectare (0.15%).

Development approach:

- Water treatment
- Development of water source
- Dam construction

5. Environmental preservation zone area is 7,711 hectare (35.54%). This area is determined by the condition of the land used for forest land outside the legal forest and miscellaneous land.

Development approach:

- Use of wood and forest together
- Forest protection and preservation
- Participation of community in environmental management

Table 4 Land use plan in Houay Namhi Sub-watershed, Nammang Watershed, Thaphabath, Bolikhamsai, Lao PDR, 2018

Zone	Area	
	Hectare	%
1. Forest zone	**6,813**	**31.40**
1.1 Protected forest zone	6,602	30.43
1.2 Forest rehabilitation zone	62	0.28
1.3 Reforestation zone under condition	149	0.69
2. Agricultural zone	**5,255**	**24.22**
2.1 Irrigation agricultural zone	431	1.99
2.1.1 paddy field	431	1.99
2.2 Progressive agricultural zone	3,873	17.85
2.2.1 paddy field	1,558	7.18
2.2.2 field crop	342	1.58
2.2.3 orchard	45	0.21
2.2.4 perennial plant	1,928	8.88
2.3 Accelerated agricultural zone	915	4.22
2.3.1 paddy field	52	0.24
2.3.2 field crop	74	0.34
2.3.3 perennial plant	789	3.64
2.4 Livestock zone	36	0.16
3. Community zone	**557**	**2.57**
4. Water resources zone	**1,361**	**6.27**
4.1 Natural water body zone	1,329	6.12
4.2 Artificial water body zone	32	0.15
5. Environmental preservation zone	**7,711**	**35.54**
Total	**21,697**	**100.00**

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

Most of the Houay Namhi Sub- watershed, Nam Mang Watershed is located in Thaphabath District, Bolikhamsai Province, Lao PDR. It has an area of 21,697 hectares. The biggest use of the area is forest land (59.25%), followed by agricultural land (23.28%). Most of the soil is low in fertility and some are with shallow depth. As a result, the suitability of paddy rice, corn, rubber, oil palm and mango are moderate to marginally.

The land use plan is divided into 5 main zones, namely the forest zone (31.40%), agricultural zone (24.22%), community zone (2.57%), water resources zone (6.27%) and environmental preservation zone (35.54%). The focus in the agricultural zone is the accelerated agricultural zone, which covers an area of 547 hectares consisting of paddy field, field crop, orchard and perennial crops because this zone is marginally suitable for growing crops.

RECOMMENDATIONS

Agricultural Zone

- Implementing the new theory for agricultural development in terms of water and land management, together with the integrated agricultural development approach to demonstrate agriculture based on the area and occupation of the people living in the area. It is an example for farmers and people who are interested to learn

- Levelling, smoothing and shaping the field surface is as important to the surface system as the design of laterals, manifolds, risers and outlets is for sprinkler or trickle irrigation systems. It is a process for ensuring that the depths and discharge variations over the field are relatively uniform and, as a result, that water distributions in the root zone are also uniform. A field levelled to high standards is generally more easily irrigated than one where undulations require special attention

- Registration of farmers for management operated by the government to understand the situation of production, to undertake agricultural development planning, as well as to support the implementation of government policies. It is also a database for monitoring farmers' assistance needs in the event of a disaster

- Encouraging farmers to integrate groups to develop knowledge, solve problems, plan production and negotiate goods

Environmental Preservation Zone

- The development of natural forests as community forests to benefit the public and for the use by the people in community

- Conservation of shrub land, marsh and swamp, which are responsible for water purification, water storage, carbon absorption and other nutrients, and support plants and animal needs

- Development of quality grazing and use for livestock