Use of the fodder tree Samata (Euphorbia stenoclada), the problem of its degeneration, and approach for mitigation: Project results of SuLaMa

In the Littoral area, the climatic and edaphic conditions do not support livestock raising based mainly on fodder grasses, but the herders are dependent on supplementary fodder plants, especially the samata-tree. The samata-tree (see Box 1) is used by cutting most of its branches off and chopping these into small pieces. The branches are transported to the village or fed to the animals directly the bush. By the cuttings, the tree is severely harmed, but regenerates after 1-3 years if there are enough branches left. The utilisation pressure on this resource is immense and has led to a depletion of many stocks. Today, in many fokontany the samata stocks are not sufficient anymore to feed all local animals. The scarcity of samata in the region has led to a situation where many trees are too much cut and cannot properly regenerate or even die.

The SuLaMa team has made various studies in order to have a deep knowledge of the use of Samata, reasons for its over-exploitation such as mismanagement, its natural and artificial multiplication and weaknesses for its domestication, and Nutritional value. This paper presents a synoptic view of the situation and the problem until a summary of the results of our studies and our approach to improve the situation will be available.

The importance of the Samata tree

The samata is the most important fodder in the dry season, particularly for zebu cattle (see Figure 1). But the coastal ecosystem also depends heavily on this endemic and endangered tree because they are the only plants to be larger than bushes, and therefore the only ones to provide shade for wildlife, cattle, and people. Thus, the villagers plant samata trees to create shade. The Vezo people use the sap to seal canoes. But the samata also plays a considerable cultural and medicinal role (see Box 2). As fodder, its nutritional value is only average (see Box 3). Its high importance as fodder resource is mainly related to its abundance and therefore the high availability of biomass (see Box 4).

Box 1: Ecological Information

At the coastal plain of the Mahafaly Plateau region, the samata (*Euphorbia stenoclada*) is a naturally dominant species, and its dominance is furthermore supported thanks to human activities such as weeding other plants nearby. As a result, the villagers turned the coastal plain into a real 'samata landscape' (Kaufmann 2004: 351). However, the samata is listed in the Appendix II of the CITES Convention and in the red list of the IUCN as Critically Endangered (UNEP-WCMC, 2003). The samata is an endemic species of southwestern Madagascar with a very limited geographical distribution. It is distributed in the West and Southwest of Madagascar in semi-arid climates, particularly in the coastal area of the Southwest, and on sandy terrain and limestone. Climate and soil are the most important factors determining its distribution: On the coastal dunes the population is very dense; while progressively, as one moves away from the sea, the number of trees decreases (on the limestone plateau and red sand) and disappears completely on the metamorphic soils (Thomasson, 1972).

Figure 1: Zebu cattle eating chopped samata

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The reasons for the problem of the degeneration of samata

The problem of degeneration and overexploitation of samata is due to increased demand, but mainly due to the reduction in supply of samata. The increased demand is a result of changes in the movement of herds in the coast and on the plateau. Coastal zebu herders were accustomed to stay in transhumance on the plateau during the rainy season, but now prefer to return to the coast after only a few weeks to avoid cattle thieves (*malaso*) on the plateau. Their early return leads to an early use of samata resources. Also because of cattle thieves, many plateau farmers began to move their herds to the coast in the dry season, meaning that many more animals have to be fed with the samata (for more information, see the document 'Dynamics of pastoralism...').

The lower supply of samata fodder is due to decreased precipitation rates and thus lower growing and regeneration rates of the trees, an expansion of private crop fields implying a shrinking of the samata areas, but mainly an overuse of the trees leading to a poor regeneration or even the death of the trees (see Figures 3 and Box 5). The latter problem is heavily related to the situation that the villagers started to privatize the historically common pool samata stocks (*samata na fokonolo*). The private samata stocks are unequally distributed among the villagers, as the privatization followed a 'first come first serve' process. Today, the samata has become a regional cash crop with a rapid increase in prices. Thus, many herders are obliged to use the remaining common stocks which are often heavily overused and thus lower in quantity and much worse in quality than the private stocks (see Figures 2 and 4, for more information see the document 'Privatization of samata').

Figure 2: Heavily degraded samata na fokonolo (south of Anakao)

Box 2: Cultural and medicinal use

The samata is used as a natural medicine, taking for example sap to heal wounds, its stem to remove fatigue, and herbal tea for women giving birth. Culturally, for example, a samata tree is planted on the former site of a dead person's hut that is traditionally burned and demolished. It is taboo to cut the tree or defile it. The samata is also used for rituals of the dead or family sacrifice, and the people put sacred objects around or on the tree. In the Tanalana belief system, if an old samata tree, considered a local heritage, falls, this is a sign of danger and the villagers must sacrifice an animal as purification.

Figure 3: Samata chopped in a non-sustainable manner

Figure 4: Private samata of good quality (Ankiririza)

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Our studies show that there is a difficulty with natural regeneration of wild samata, represented by a deficiency in young individuals (see Box 5). This difficulty may be due to various reasons, such as the attack of fruit-eating insects after dissemination, water deficiency during germination, or the damage of seedlings by livestock. Moreover, the villagers' habit to 'multiply' the samata in the village or on private land by digging up the wild seedlings of the bush, reduces the biomass and regeneration of the wild stock and thus contributes to its degeneration.

Possible solutions to the degeneration

The main problem is that the villagers still have no knowledge of how to multiply the trees for mitigating the pressure. Many villagers see the degradation of the samata-trees as a big problem for the region. Villagers talking to members of the SuLaMa team frequently showed a high interest in receiving assistance in learning how to reproduce samata. Our experimental multiplication trials with cuttings of the local variety of samata showed a considerable success (see Box 6). The multiplication technique with using cuttings does not demand much material or technical knowledge, but only some general practical knowledge and tricks (see the *Guide pratique pour la bouture de samata*). Providing the villagers with knowledge about the multiplication is thus a promising approach to help the regional animal husbandry to survive and beware the ecosystem from further depletion. SuLaMa-WWF has started its first samata community nursery in April 2015. Together with the local COBA, 90 small trees derived from cuttings were planted in the village of Ampotaka. As the multiplication is – compared to other species – relatively easy and the small trees do not need much care, samata can not only be multiplied out of professional plantations, but by the villager themselves. The spreading of multiplication knowledge also helps reducing the utilization and removal of trees from the fokonolo-areas and thus may lead to a recovery of the wild stands. A first multiplication workshop took part in May 2015

Box 3: Quality of the samata as fodder

Our field experiments show that samata has only limited nutritive value. However, in the dry season it is crucial for the nutrition of local livestock, and due to a water content of about 75% also an essential source of moisture. Despite its depletion, it still occurs in higher abundance along the coastal strip and offers higher biomass yields during the dry season than most other potential forage plants. In comparison to the also commonly used dry season supplemental forage species, the prickly pear cactus (*Opuntia sp.*), samata shows higher concentrations in crude protein (69 g/kg DM/Dry Matter) and phosphorus (1.2 g/kg Dry Mass), but also in fiber fractions (NDF = 518 g/kg Dry Mass, ADF = 413 g/kg Dry Mass). In contrast, both its digestibility (48%) and metabolizable energy content (8.3 MJ/kg Dry Mass) is lower compared to the cactus. The concentration of condensed tannins, which may reduce protein digestion in animals, is negligible in samata (0.034%). Compared to other local browse species, its concentration in crude protein and phosphorus is inferior, and may not be sufficient to cover the animals' energy and nutrient requirements, if fed exclusively. Therefore, local pastoralists should try to diversify their animals' diet, for example by also offering good quality hay.

Figure 5: Creation of a community plantation in Ampotaka

with around 20 villagers from three fokontany. The participants visited the multiplication trials and after having discussed the technical tricks they planted their own cutting.

Additionally, to contribute to improving the modality of cutting of adult samata trees, a comic strip was produced that shows with local images the negative impacts of unsustainable cutting modalities (see Figure 7).

Box 4: Use of samata and its impact on the stands

Of the 68 plots (30 m*30 m) which were placed in the wild population of samata, we found that farmers begin to cut the branches of trees from a diameter of 2.5 cm DBH (Diameter at Breast Height). At a DBH between 2.5 and 5 cm, 21% of individuals are cut (see Table 1). Cutting becomes important from 5 cm on (74%) and from 7.5 cm DBH on, almost all (92%) of the trees have traces of being cut.

The villagers do not harvest the young seedlings, especially because of the small amount of biomass they produce. The medium sized individuals are preferred due to the ease of harvest and because their branches are still young and only moderately lignified. Therefore, average diameter trees (7 to 10 cm) are the most affected and used.

Three methods of cutting were observed, the most common cut is at the branch level, then at the apical meristem, and finally at the trunk. These last two result in the death of individuals as opposed to branch harvesting (except when the harvest is excessive). Overall, our data shows a mortality rate of trees cut of 13-22%. However, thanks to the regenerative capacity of the samata by renewing shoots, about 45% of trees that died after cutting them down revive through shoot regeneration.

Individuals of medium and big size form shoots in the instant the branches are harvested or the trunk is cut, just before the rainy season. Wild samata is still able to multiply, but there is also a difficulty of natural regeneration represented by a deficiency in young individuals: For 230 adult trees with an DBH over 5 cm per ha we found only 134 juvenile trees.

Box 5: Biomass yield of samata

Based on the 68 observation plots of 30 m*30 m, we calculated an average density of 400-450 individuals/ha. These trees produce about 0.8-1.0 t/ha of biomass dry matter available for animal feed. Indeed, the carrying capacity is approximately 0.38 TLU/ha/year (TLU: Tropical Livestock Unit). Average biomass on adult tree does not differ much with distance from the village. For young trees, the highest production (0.3 t/ha) is localized around the village (1000-1500 m) or further away (2000-2500 m). The lowest production (0.1 t/ha) is found between 1000-1500 m distance. At a distance of 1500-2000 m an average biomass production (0.2 t/ha) is found.

Table 1: Results of the analyses of wild samata stands

		Distance (m) of plots (n) from village			
		<1000 n=22	1000-1500 n=21	1500-2000 n=18	2000-2500 n=7
Density (individuals/ha)	Young individuals (<10 cm DBH)	386	394	364	352
	Mature individuals (>10 cm DBH)	76	42	46	101
Biomass (t/ha)	Young individuals	0.3	0.1	0.2	0.3
	Mature individuals	0.7	0.7	0.7	0.6
Percentage of cut individuals (%)	2.5-5 cm DBH	24	17	24	18
	5.1-7.5 cm DBH	73	66	77	81
	7.6-10 cm DBH	95	89	96	87
	>10 cm DBH	95	96	93	96
Mortality rate (%) after cutting		16	22	20	13
Rate of shoot revival (%) after being cut to death		46	42	38	49

Figure 6: Workshop on multiplication of samata by cuttings

Box 6: Natural and artificial propagation of samata

The Samata naturally reproduce sexually by germination and vegetatively by shoot rejuvenation. Growth is very slow and the plants begin to bloom only from 4 to 5 years old. The flowering period comes between the months of September and October. Our research shows that the multiplication of samata by germination and cuttings in the natural environment is possible. The germination study shows an average rate of 50% germination for all used pre-treatments, with the control seeds having the best rate (80%). During a 5 months follow-up, the transplanted seedlings showed the best rates of growth and viability compared to seedlings from direct sowing. The germination rate decreases with increasing salt concentration in the water, but in favorable conditions seed germination does not seem to pose an integumentary threat.

The test on propagation with cuttings in a nursery tested different factors such as shade, hormones and substrates (red sand, calcareous soil and white sand). The non-hormone-treated cuttings on the white sand substrate showed best growth. All cuttings that were installed under shade died, however, for those growing in an unshaded system, the mortality rate is only about 10%. The cuttings need to be regularly watered and must be transplanted after 4-6 months development of the roots and shoots. As conclusion, the artificial multiplication with cuttings showed good results, is technically easy, faster in comparison to germination, and so is the preferred method.

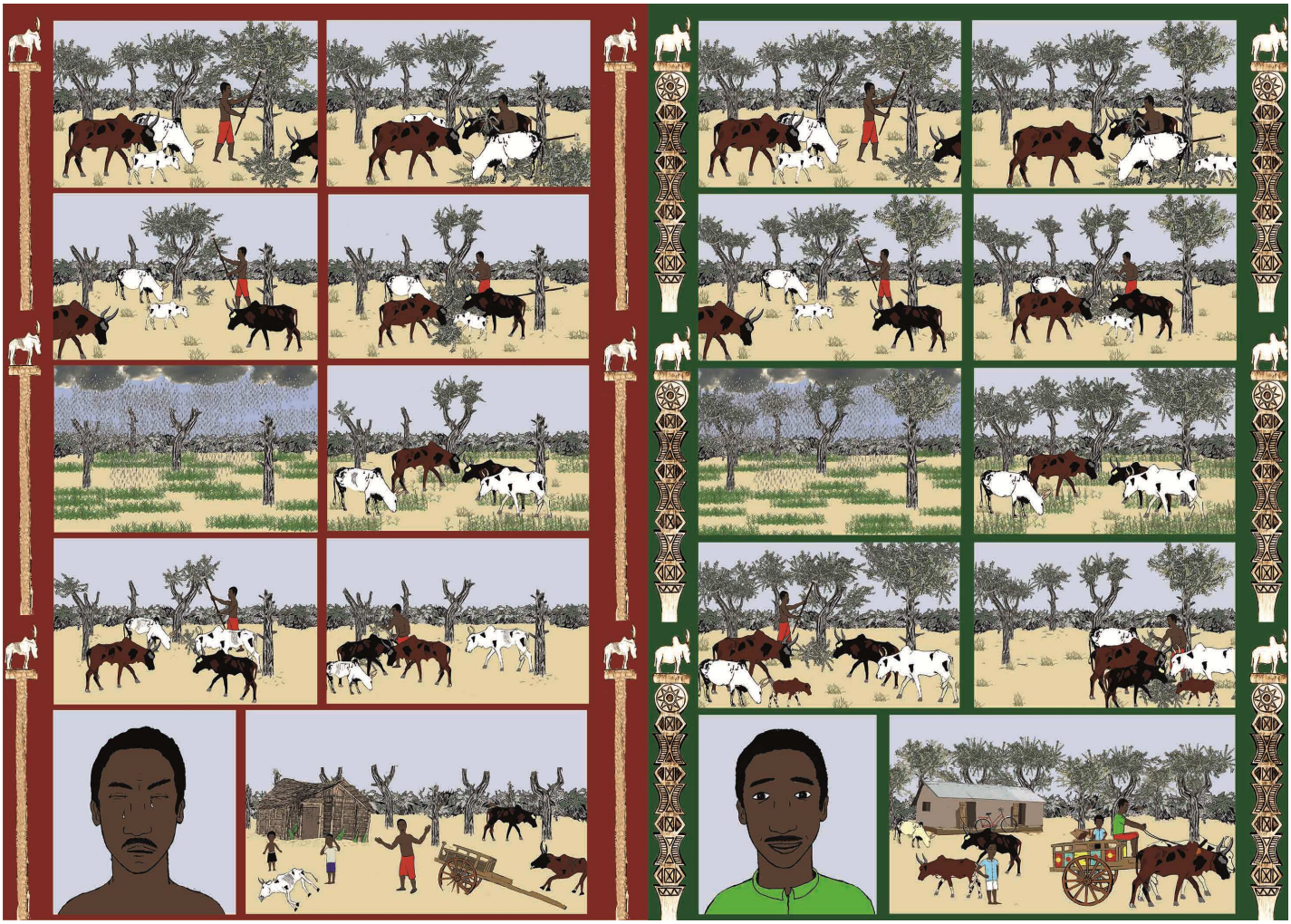

Figure 7: Comic strip on the negative impacts of the unsustainable cutting of samata (by David Weiss)

Cited literature: Kaufmann, J. 2004: Prickly Pear Cactus and Pastoralism in Southwest Madagascar. Ethnology 43 (4):345-361. Thomasson, G. 1972: Remarques sur Euphorbia stenoclada Baill. Adansonia 12 (2): 453-60. UNEP-WCMC 2003: Checklist of CITES species. UNEP-WCMC: Cambridge.

Conception: Johanna Goetter, **Text and data:** Johanna Goetter, Goum O. Antsonantenainarivony, H. Stone Tahirindraza, Tobias Feldt, Herinavalona A. Rabemirinra, Frauke Ahlers, **Figures:** Johanna Goetter, Corina Müller, Yeddiya R. Ratovonamana, Goum O. Antsonantenainarivony, David Weiss