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## Produce to Exchange : The Taro Water-Gardens on Vanua Lava (Vanuatu), a Social and Sustainable Place

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## Produce to Exchange: The Taro Water-Gardens on Vanua Lava (Vanuatu), a Social and Sustainable Place

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On the west coast of Vanua Lava (Banks group, North Vanuatu), farmers do not only cultivate taro on irrigated terraces to live, but live to cultivate and eat taro every day. Taro holds the memory of the ancestors, the village, and the place of its production. This place—the taro water-gardens—is named *rot*, and is described in this article from an ecological and social point of view. The main goal is to understand why the inhabitants of the west coast of Vanua Lava are producing so much taro. *Rot* has to be managed with water canals, and includes *qēl* which are irrigate pondfields with wet and dry alternation structured in terraces (7.10 t dry matter/ha), *mat* which consists of modified rivers or streams (20.1 t/ha), and *boak* which are drained swamps (10.2 t/ha). The difference between estimates of the taro consumed (95.7 t) and the taro produced each year (146.5 t) leaves us to believe that a lot of taro is harvested in surplus for local subsistence needs, which reinforces the ‘social generosity’ characteristic of Melanesian societies. The taro water-gardens of Vanua Lava offer a considerable food potential for the population of today and tomorrow.

### 1. TARO, A PLANT IN TOUCH WITH THE ANCESTORS

Irrigated pondfield terracing is a system of cultivation that has declined throughout much of Oceania or has even been abandoned. Reasons for this growing indifference have been summarized as ‘European contact and establishment of colonial relations, an end to traditional internecine conflict, population decrease, and the emergence of island society into a global marketplace’ (Kuhlken 2002: 186). According to the same author, persistence of such a time-consuming activity is mainly due to ‘cultural forces’. This paper will show how such ‘forces’ are indeed glorified by people living on the west coast of Vanua Lava (Banks group, North Vanuatu).

The inhabitants of Vanua Lava display without a doubt a culture based on taro (*Colocasia esculenta* L.). Taro is good to eat and to think. They do not merely cultivate taro to live, but one could almost say that they live to cultivate and eat taro every day. This ‘taro civilization’ to borrow A.-G. Haudricourt’s (1964: 93) expression ‘yam civilization’ for New Caledonia, produces a landscape and a particular system of spatial organization based on the various practices of production and social organization. As an important object of culture, taro establishes a link between two worlds; the surface where people live and the chthonian world where the dead live, whose knowledge, vegetal material and taro water-gardens are inherited

(Caillon and Degeorges 2007).

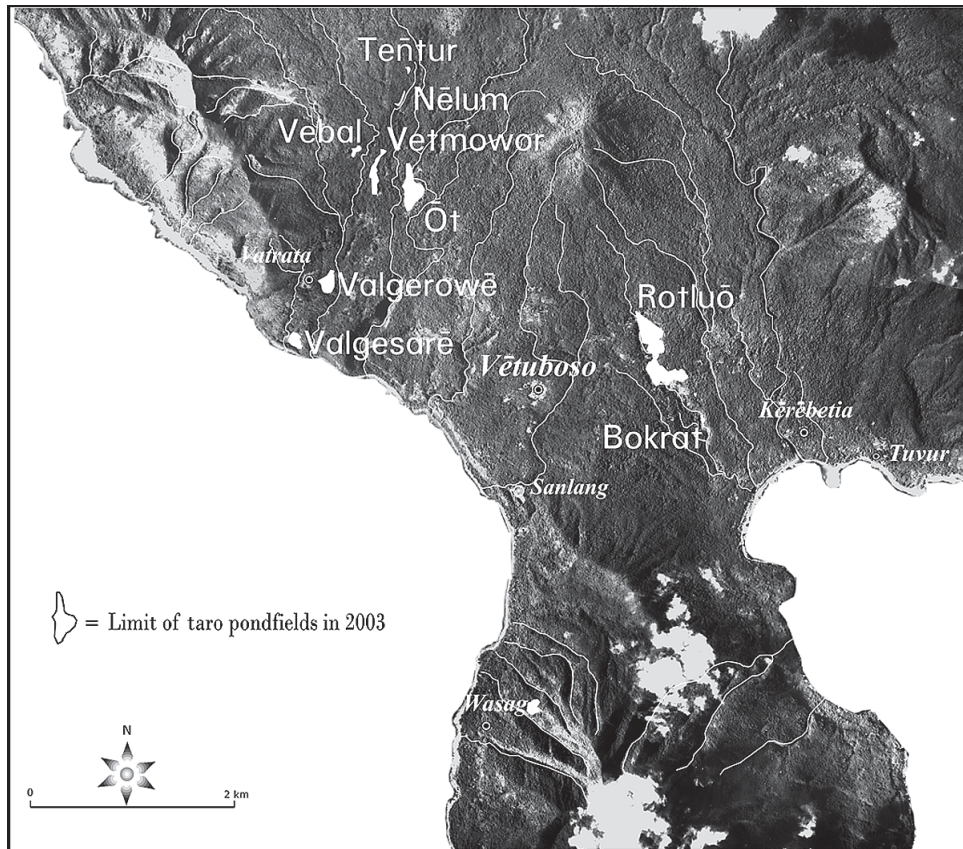
Taro is a subsistence plant that the farmers multiply by means of vegetative reproduction. In this orally-based society, where material objects do not last long in the humid and cyclonic environment, this plant is an immutable object transmitted from generation to generation, due to its capacity for identical reproduction year after year. Taro thus holds the memory of the village.

People give a place to each plant according to its aesthetic qualities, its use of time (Walter 1996), but also its history and ties to the ancestors. In consuming taro, one also consumes the place into which the corm plunges its roots to extract the elements that nourish it and give life to the people of the island. The plant transforms the soil, a substance charged with symbolism and tied to the ancestors, so that by eating taro the people of today can ingest a piece of the past. In this way, the living maintain a link with their dead and with the social values incarnate in the place of its production, the taro water-gardens. Taro has definitely a symbolic significance on Vanua Lava.

In its place, taro is ‘king,’ to paraphrase Bonnemaïson’s (1991) title, since it is the guardian of a wealth of knowledge, in ways possibly unique to Vanuatu and the Pacific. His place of cultivation is named *rot*, or taro water-gardens (Fig. 1). They have to be managed with water canals that irrigate pondfields structured in terraces. Other systems of taro cultivation, in rivers and swamps, can coexist (but not rainfed agriculture). These taro water-gardens (*rot*) are perceived by the inhabitants of Vanua Lava as a heritage derived from the ancestors because of the particularities of their history and geography. Their units of space



**Figure 1** The taro water-gardens named Rotluō cultivated by the inhabitants of Vētuboso, Vanua Lava



**Figure 2** West coast of Vanua Lava island, Vanuatu, with main villages and main rivers. Taro water-gardens are shown in larger size. GPS surveys were made by S. Caillon (2001–2003).

(pondfields, rivers or swamps), cultivated or not, can also be inherited. Land transmission rules, which are inventoried in this paper, help in understanding the precise function and social value of taro water-gardens. Land is not the single element to be inherited; knowledge and practices associated with the cultivation of taro are also passed on from generation to generation. Their complexity and diversity is detailed before the analysis of their performance in terms of yield and quantities. The goal of this article is to understand why the inhabitants of the west coast of Vanua Lava are producing so much taro.

## 2. TARO WATER-GARDENS AS HERITAGE: THEIR HISTORY AND GEOGRAPHY ON VANUA LAVA

The taro water-gardens described in this article are situated above the village of Vētuboso on the west coast of Vanua Lava, the largest island (331 km<sup>2</sup>) of the Banks archipelago (Vanuatu, Fig. 2). The 610 inhabitants (Hess 2009) are mainly self-sufficient for food, primarily taro,



and their main cash income stems from copra export (dry coconut meat used to extract oil). Lying between the mountains at an elevation of about 150 m, Vētuboso is relatively isolated and is served irregularly by commercial boats.

Vētuboso's taro water-gardens could be classified as 'hillslope terraces' requiring more complex and fastidious technology than 'channel bottom terraces' (Doolittle in Kuhlken 2002). They are on the leeward side of the island but nonetheless get a lot of rain, because they are located at a moderate elevation (maximum 240 m) between two summits (595 m to the West and 459 m to the East). The water does not come from the windward slopes, but directly from the rivers that run from north to south. A number of authors writing about taro irrigation in the Pacific (Spriggs 1981; Kahn 1984; Yen 1990; Vargo and Ferentinos 1991; Kirch 1994)<sup>1</sup> differentiate three systems of wet farming that are also found on Vanua Lava:

- (i) Taro in irrigated pondfield systems: in basins or rectangular plots (in Vētuboso, 68.5% of the surfaces from a sample of 9 households—5 pondfields per household from a sample of 56 informants): *qēl*, pl. *qēlaqēl* in Vurēs<sup>2</sup>) (local language).
- (ii) Taro grown in rivers or streams, between the rocks of a naturally inundated environment (27.5% of surfaces—2 plots per household). These are called *mat*, which means 'river', and include the *mat wōwōres* ('something small and numerous') when the taro is planted amongst small rocks and the *mat vetvet* ('rocks') when the riverbed is covered with large rocks.
- (iii) Taro in swampy areas or in the mud near rivers (4% of surfaces—0.4 plots per household): *mat boak* or *boak*, which means 'mud.'

After taking GPS points between 2001 and 2003, a map of the principal taro water-gardens was made (Fig. 2). Whether in irrigated pondfields, rivers or swamps, taro water-gardens, covered a total surface area of 20.6 ha in 2003 (Table 2). The taro water-gardens cultivated by the people of Vētuboso are divided into six large groups named respectively Ōt<sup>3</sup>) (5.9 ha, between 160 and 200 m elevation), Teñtur 'rainy place' (0.1 ha, 200–240 m), Nēlum (0.1 ha, 200–240 m), Vebal 'two rocks are a place' (0.4 ha, 200 m), Rotluō 'big taro water-garden' (14.0 ha, 40–80 m) and Bokrat (0.1 ha, 40 m). The people of Vatrata and other hamlets to the north also use named taro water-gardens established in pondfields, rivers and swamps. Among these are Valgerowē (2.5 ha, 80 m), Valgesarē (1.6 ha, 40 m) and Vetmowor (2.3 ha, 160–200 m). Smaller gardens called Venbala, Sereba, Betem and Pomiē, are located north of Vatrata along the coast.

The first taro water-gardens on Vanua Lava were created by the founding hero, a *vu* spirit named Lakakēris. They have a sacred character associated with the origin myth of taro, and even agriculture in which Lakakēris is the principal actor. Following is a limited version of the story, told by John-Elizabeth Kōkōr in Vētuboso (2001).

"Lakakēris lived in a place named Beut, at the extreme southeast end of Vanua Lava. When his brothers stole his wife, he decided to leave Beut and begin his search for women. At the time, the people of the island ate wild *wōbōw* [aerial yam, *Dioscorea bulbifera* L.] taken from the forest. Women had to wash the roots in rivers before cooking them [i.e., to detoxify them]. Lakakēris brought with him everything he needed (pondfields, water, and taro) to make irrigated

gardens. He visited a number of places, and wherever women agreed to have sexual relations with him, he installed irrigated pondfields. The largest area, comprising the taro water-gardens of Ōt, Vetmowor, Teñtur and Nēlum above the village of Vētuboso, was created through the union of Lakakēris and Ro vōnōlav<sup>4</sup>.”

Mythical sexual union is thus inseparable from the creation of the first taro water-garden. According to Bonnemaïson (2000: 249), ‘the geography of the places visited by the civilizing hero [ . . . ], the itinerary he traced, the places where he revealed his magic power, form a symbolic spatial structure that formed and created the territory.’ The other taro water-gardens, Vebal, Rotluō and Bokrat, were created later by the ‘ancestors’ at least three generations before the present inhabitants.

The rivers, *mat*, are easy to cultivate and the taro grows quickly there, producing large corms; these are said to be the gardens for those who do not know how to work, the gardens that even an orphan can take care of. These rivers and their taro (five cultivars) have in effect been ‘brought’ by another mythic character, a *vu* spirit represented by an orphan named Wōmōdō. Hosea Waras (Vētuboso, 2003) told me this story about Wōmōdō:

“A young woman had to laboriously wash [i.e., detoxify] her yams [aerial yams] in the river every day to feed her parents and family. One day, while she was doing this laborious task, she saw a handsome young man, Wōmōdō. Each time she tried to approach him, he disappeared between the rocks of the river. One day the woman found his hiding place by a trick, and tried to convince him to marry her. He refused because he was an orphan. Then the father of the young woman, starving, came to the river to see what was making her late. He surprised them and threatened to kill the two of them with arrows, but Wōmōdō negotiated their liberty by promising him a mat planted with taro that did not need to be washed in the river. The next day, the woman found the mat and its taro, but without Wōmōdō” (Hosea Waras, Vētuboso, 2003).

The swampy areas, *boak*, do not have known customary stories associated with them. The colour and muddy taste of the taro grown in these places is not well liked. Only women, or a family living too far away from the village and the taro water-gardens to use the pondfields, cultivate them a lot. But this type of cultivation can be difficult, since each passage on foot between the taro plants might crush and kill the young taro roots.

These three kinds of cultivation area (*qēl*, *mat*, *boak*) are all part of the taro water-gardens or *rot*. However, some taro is planted in rivers or swamps outside the large groups (and were not included in my survey); but they are not just anywhere. Taro is sensitive to its environment and a bad choice might have grave consequences. As Eli Field Malau said “*Qiat owē neke vasnē lamasarave mōrōs*” (Vētuboso, 2002), the taro will be good if you find the place that it loves. If taro is not planted in its proper place, curses will fall on the family that eats it. For example, according to village rumour, a family was cursed by its taro being planted in a bad location. One of three sisters and three of four brothers are albinos, and the father of the family is deformed. The place for taro should be indicated by the ancestors.

Place is central to people’s understanding of themselves and their relationships. Rodman observed that one cannot be a person from the place, a *man ples*, and be divested of land

(Rodman 1986). On Vanua Lava, not having access to land is a cultural impossibility, as it implies not having a family or a place. It would simply deny one's existence (Hess 2009). In the following section I will analyse the inheritance of taro water-gardens in light of general land transmission rules.

### 3. INHERITANCE OF TARO WATER-GARDENS

Social organization in Vētuboso is based on belonging to a matrilineal *vēnēm*, or clan. There are 18 clans grouped into two moieties (Hess 2009: 22). While *vēnēm* membership is matrilineal, residency patterns are predominantly patri-virilocal. Marriage partners should ideally be chosen from the opposite moiety. The socially valued wedding is a symmetric relation displaced by one generation: the daughter of the maternal grand-mother's brother (*tēvut marēuk*) (Hess 2009: 19). Inhabitants of Vētuboso have to know their *vēnēm* if they want to claim any rights to land.

The ways in which taro water-gardens as a whole are passed down differ from those of its components (pondfields, rivers and swamps), other mixed gardens, plantations, or any cultivated space on the island (see explanation below). The soil of a taro water-garden, *tan vēnēm*, belongs to a single clan or *vēnēm*. Ownership of a whole taro water-garden does not alternate at each generation in line with the *vēnēm* of the mother. This noteworthy difference might be explained by the fact that the space of the taro water-gardens is limited (according to what Lakakēris and ancestors have created), while that of the island's interior seems infinite; forest can always be replaced by mixed gardens and plantations as soon as the user has the proper rights to do so.

However, ownership of the soil of a taro water-garden may change over time. In this case, the *vēnēm* is said to have lost its rights following "bad marital strategies", but unfortunately I could not obtain more detailed information about this process. Today, the soil of taro water-gardens cultivated by the farmers of Vētuboso—Ōt, Teñtur and Nēlum—are in the custodianship of the *vēnēm* Lō, while *vēnēm* Qōñ is custodian of Rotluō, *vēnēm* Veñlō of Vebal (though previously *vēnēm* Lō is said to have been custodian), and *vēnēm* Beut (previously *vēnēm* Seber) of Bokrat. The *vēnēm* Qōñ hold the rights over the taro water-garden Sereba and Pomiē, cultivated by the inhabitants of Vatrata, and have lost those of Betem, which is today under the control of the Veran. The soil of the taro water-garden Vetmowor belongs to the *vēnēm* Go after having been for a long time in the hands of the Lō.

The oldest male (and by default female) of a *vēnēm* is custodian of a taro water-garden, and does not have use rights in cultivated pondfields, rivers and swamps, but is nonetheless the person to make any final decisions concerning the general management of the taro water-gardens (for example, cleaning of the water source and irrigation canals). When a cultivated area (*qēl*, *mat* or *boak*) is abandoned, the *vēnēm* custodian of the taro water-garden's soil, however, reclaims rights to the place. Putting a pondfield, river or swamp back into cultivation requires the approval of the *vēnēm* custodian. Barring any outstanding property concerns, authorization to a prospective planter is given the moment that a common ancestor, from either the paternal or maternal side, is found to claim a tie to the common *vēnēm*. Given the close-knit community, this tie is almost always possible.

Upon the death of the head of a family, the rights over cultivated pondfields, rivers and swamps are resolved during the *ununseg* and *wotwot* ceremonies (Hess 2009: 122). At the *ununseg* ceremony the deceased's children make payments to their father's *venēm* and all people that their father is related to, including adopted family. But the main payments are made to the deceased's brothers, to their children, and to his sisters' sons. The land thus changes 'sides' as custodianship henceforth belongs to the sons<sup>5)</sup> of the deceased man, who in turn belong to their mother's *vēnēm*; land alternates along the patriline.

When a father dies, his children keep the areas planted with taro, and the mother can work those planted by her deceased husband in the name of their children. Use rights are however more extensive. In executing this ceremony, the use rights to pondfields, rivers and swamps extend to all the cultivated places of the brothers and sisters of the father, after asking permission from the oldest brother. Thus a man is not the sole proprietor of a pondfield, since the rights are shared among brothers. However, whoever farms it has ownership, in the sense that he gathers the harvest and others cannot come there and plant their taro.

During an *ununseg* ceremony, a cultivated pondfield can also be inherited from a person other than the father, most notably the maternal uncle. A person can also gain a pondfield through work: a young man, by helping clean up and put back into service an abandoned taro pondfield system on the heights of Vētuboso (Nēlum) inherited two pondfields. A pondfield can definitively leave the control of a *vēnēm* by payment through a *tantun* ceremony. With the help of a little money, by doing the *tutuleg* ceremony a person can also "lease" a pondfield, with the right to farm it for few years, generally five. No particular family ties are required, but the renter is not supposed to hand it down to his descendants. During the "lease" period, the lenders maintain a sense of domination over the renters. Thus, the lenders create new allies in a kinship group that is not necessarily their own. During disputes within a village, a family cannot argue against the family from whom they have borrowed a pondfield, out of respect but also fear that they might lose their rights over the pondfield. It is thus a means of restraining competition within the framework of the struggle for power and enrichment.

In Vētuboso, cultivated land has a different status from "wild" or abandoned land. The former are the domain of an individual while the latter are controlled by groups. Thus, though the production of a pondfield, river or swamp is destined solely for its cultivator, and although they belong to a group of owners, often from the same *vēnēm*, all cultivated land of a taro water-garden is managed by a mosaic of farmers coming from all *vēnēm* present in the village.

Taro water-gardens are permanent in space, despite a crossed system of transmission of land: a swampy area or a river is never exhausted, and a pondfield can be cultivated between 7 and 15 years. Tactically a father passes down his cultivated land to his children while still alive, even before they marry. He thus guarantees the transmission of part of his land planted with taro. Moreover transmission is not strictly codified, and profits from the flexibility of a system that wants to be at the same time matri- and patrilinear. Each must find his own path to become a person of the place, a *man ples*. One person will more easily gain access to a plot of land if he knows its history, that is to say the chain of kinship ties that connects it to the present users. When someone gains access to a pondfield, river or swamp in any taro water-garden around Vētuboso, he/she can claim his/her identity as belonging to the place, to the *vanua*. But this is not enough. A real "man or woman Vanua Lava" has also to prove his



capacity to take care of the plants growing in these socially valued places. He/She should know the complex and multiple practices associated with this unique system of irrigation.

#### 4. HOW IT WORKS

In irrigated taro pondfield systems on other islands (today Maewo, Pentecost and Santo<sup>6)</sup>, taro develops in water throughout its cultivation cycle, from planting to harvesting. In those agroecosystems, the main rule is that water should always flow to prevent any increase in temperature (Kuhlken 2002). Contrary to this practice of continuous immersion, the farmers in Vētuboso plant their taro in dry soil, then alternate wet and dry phases until finally harvesting the taro when the soil is dry. Immersion in water not only allows the taro to feed on nutrients but also to combat, among other pests, the beetle *Papuana huebneri*, *gōsōs*, which feeds on young corms. Weeding also becomes easier as water softens the soil. Since less water is used for planting than on other islands, a greater number of individual pondfields can be cultivated. Compared with rainfed agriculture, alternating irrigated gardens can be said to be intensive and sustainable because taro growth occurs more rapidly, the fallow periods are shorter and burning is limited.

Women are forbidden access to the sources of water (*nōgōbē*)<sup>7)</sup> for taro water-gardens brought by the hero Lakakēris. Maintenance of the water sources and irrigation canals remains the work of men placed under the responsibility of a representative of the *vēnēm* having rights to the ground of the taro water-garden (Fig. 3). Communal labour is organized if the system suffers from physical deterioration. The space occupied at the top of the taro



**Figure 3** Eli Field Malau from Vētuboso village is repairing a water channel (photo at Rotluō, 2007)

water-gardens, near the source of water, is called *qöturot* compared to the middle, *vētinerot*, and the space below, *qērērot*. While the pondfield systems at higher elevations are known never to want for water, even during periods of drought, the soil is less rich than those in the valleys. The latter, however, suffer during drought and receive less water, even during normal periods. The water, directed by canals (*gabē*) bordered with stones, is distributed to stepped terraces that follow the contours of the hillsides or to valleys. Individual pondfields have an average surface area of 87 m<sup>2</sup> (from a sample of 57 basins). They are separated by walls made from a mixture of stones, earth, and plant debris. According to Speiser (1923 [1990]), Vienne (1984) and my personal observations, the now-abandoned taro water-gardens on Siritimiat mountain were divided by stone walls. The height of the walls depends upon the slope. The entry point for the water in each pondfield is called *varwöwbē*. In the pondfields, earthen dikes (10 cm) mark out the sub-basins or *tin*. They are on average 2.1 sub-basins of about 42 m<sup>2</sup> comprising each pondfield or *qēl*.

The pondfield walls and internal (sub-basin) dikes are planted with useful plants. Some of these plants are edible while others, according to the farmers of Vētuboso, protect the taro by their magic powers, repelling “by their odour” the beetle *Papuana*, or preventing attacks by the fungus *Pythium*. Among these “magic” plants, the most popular are cordylines or *dagarē* (*Cordyline fruticosa* (L.) A. Chev.), one variety of which is called *dagarē tañsar*, and crotons (*Codiaeum variegatum* (L.) A. Juss.), whose generic name is *kirkiar* and the varieties of which are *kirkiar mēter*, *kirkiar qere qō*, *kirkiar qet*, *kirkiar sas qōñ* and *kirkiar mamegin* (for a full list, see Caillon and Lanouguère-Bruneau 2005). These plants not only brighten the taro water-gardens with their diversity of colour and form, protecting the taro against disease, but also strengthen the walls by retaining the soil without spreading, due to their shallow roots.

Taro cultivation by alternating irrigation is a difficult art, requiring a long apprenticeship. Both women and men work in taro water-gardens, although there is a general gendering of work where women seem to do most of the weeding (Fig. 4), and men most of the planting and of the preparation of new pondfields that have been abandoned for long time. Without being burnt first, the vegetation of a fallow pondfield is removed, or even may be used to reinforce the walls between the pondfield basins (for this, banana stipes are especially suited). Only the vegetation in pondfields that has not been used for more than 50 years is treated like that in the mixed gardens, that is to say cut down in July and then burned once after drying. According to the farmers questioned, the soil of pondfields never becomes depleted. The people of Vētuboso attribute to this cultivated space the characters of continuity and immortality. Under this system of cultivation, the pondfields are on average planted and replanted for seven years, and then are left fallow for one or two years. The period of fallow depends on the availability of land, the quality of the soil, and the position of the pondfield within the taro water-garden. It is said that the ancestors used to turn over the ground after two years of growing taro (an act called *gilrisris*), although I have never observed this practice today.

Previously, fertility was maintained by chants, magic leaves burned and dispersed in the water of the pondfield, or leaves enclosed in a coconut shell, itself buried at the water inlet. According to Bourdy *et al.* (1995), these leaves were from *Freycinetia monticola* and *Plectranthus scutellarioides*. Leaves from *Psychotria trichostoma* (*bititiqō* in Vurēs) could

also be chewed and the juice spat out onto the young taro plants. In the villages Mosina and Sisiol, the same authors said that leaves of *Clerodendrum inerme* buried in the garden prevent attacks by the beetle *Papuana*. Other pests threaten the taro harvest, such as the worm *mēlēsteñtñ* (“worm that cries”), the caterpillar *wötörör*, a small white insect *wörumrum*, and rats. Every family, or rather every individual, always has their own secrets that they share with caution<sup>8</sup>. Often this knowledge will be passed down to a single son, one who has shown a particular aptitude for growing taro and for the well-being of the father of the family. Even if they know of some, many farmers prefer not to use magic leaves for fear of using them



**Figure 4** Freda Malau from Vētuboso village is weeding her pondfield or *qēl* while the ground is dry (photo at Rotluō, 2009)



**Table 1** Time sequence for growing taro in *qēl*

Wet/Dry	Action	Local name (vurès)	Period
Dry	Planting	<i>riv</i>	4 weeks
Wet	Initial introduction of water	<i>varwöwsērēt</i>	3-5 days
Dry	First weeding and holes clean-up	<i>vēlisgōgōn</i>	3 weeks
Wet	First flood	<i>turgibē</i>	2-4 weeks
Dry	Second weeding and holes clean-up	<i>turgi vēlis</i>	3 weeks
Wet (optional)	Second flood	<i>turgibē</i>	2-4 weeks
Dry (optional)	Third weeding and holes clean-up	<i>turgi vēlis</i>	3 weeks
Wet (optional)	Third flood	<i>turgibē</i>	2-4 weeks
Dry (optional)	Fourth weeding and holes clean-up	<i>turgi vēlis</i>	3 weeks
Wet	Final flood	<i>qētqētnebē</i>	8-16 weeks
Dry	Final maturation	<i>lesoqē</i>	8-12 weeks
Dry	Harvest	<i>sigsig</i>	4-8 weeks

wrongly and thus spoil one, if not many, harvests. Nevertheless, a good use of alternating irrigation, conscientious weeding (*vonodöwö* for the plants and *ōmōñ* for the act), and the elimination of pests, can replace the use of magic for the most part.

In a single pondfield the harvest is spaced out over one or two months, since the planting of taro generally takes place in three stages, approximately every week. The taro cuttings in a sub-basin have to be planted in less than a month so that the initial introduction of water can limit the proliferation of the beetle *Papuana*<sup>9)</sup>. In fact, the rhythm of planting depends on the weather conditions, the availability of the farmer, and his social aspirations. If there is too much sun, the farmer will speed up the rhythm of planting so that the soil around the young taro will not dry up before the first introduction of water. If a family is in need of money, the man might concentrate on working in the coconut plantations to produce copra, at the expense of the taro water-gardens. Finally, if a man decides to reaffirm his social rank, he will plant a lot of taro at the same time in order to be able to organize a grand communal feast.

The farmers' technical expertise is especially illustrated by the manner of judiciously alternating the flooding of the pondfields according to the needs of both the taro and the farmer's family (Table 1). Taro is planted in dry soil with a digging stick called *gil* carved from a hard wood, *wu* (*Ixora aneityensis* Guillaumin). The water enters the pondfield at a single point, and is not allowed to flow out again, which is in contrast to the practice on other islands such as Maewo where pondfields have an outlet as well as an inlet. According to local informants, circulation is artificially reconstituted by alternating the wet and dry periods to avoid the stagnant water getting too hot. Unlike in systems where the water circulates, the nutrients brought by the irrigation water and the soil of each pondfield do not escape into the next field situated below. Since the basins do not have drainage, the walls separating them are not very high so that the taro will not be drowned in case of heavy rain.

The initial introduction of water, called *varwögsērēt*, lasts only three days in order to allow the first roots to develop and to "soften up the weeds" that have had the time to grow during the course of the planting. In addition, since the taro is not all planted at the same time, the farmers say that the initial flooding allows them to synchronize their growing stage. The

weeds are easier to pull out during the three weeks of the dry period, called *vēlisgōngōn*, that follows. The dead weeds, in particular those called *wōtutgō tamarge*, are then put between the taro as a mulch or fertilizer. For one planting cycle, two or three weedings, corresponding to the dry periods, are necessary. Each time that the soil is dry, the holes in which the taro is planted need to be cleaned to remove soil that has accumulated. The first real flooding, *turgibē*, lasts between two weeks and a month, allowing the leaves of the taro to grow. After a dry period of three weeks, when the weeds are pulled up, the second *turgibē* of a month softens the soil so that the taro develops more easily. A new dry period of three weeks gives way to the final introduction of water, called *qētqētnebē*, for two to four months. The taro is not harvested until after a dry period of two to three months, when its leaves fall. This time sequence is adapted to taro growing for between seven and twelve months. If the taro does not grow well, a third *turgibē* can be inserted before the *qētqētnebē*, and if the taro grows especially well, the second *turgibē* can be skipped.

The dates for flooding the pondfields are not conditional upon the season, since taro is planted throughout the year. The art of irrigation consists of adapting the introduction of water according to the growth of the plant. The instructions given here are a kind of flexible guide that can be adapted to the reactions of the plant. According to the farmers, the plant shows that it needs water when its leaves wilt and soften, or when the young rolled-up leaf points toward the water inlet. Water is withdrawn if the leaf turns away from the water inlet. The periods of water depend not only on external climatic and soil constraints; they are also subject to human constraints. In effect, the farmer can modify the maturation time of corms by playing with the dry phases. For example, if he wishes to shorten the period of maturation, the second period of water (*turgibē*) will last two or three months, instead of one, in order to “kill the roots.” The taro will become ripe more quickly, though not as good because it will be soft on the inside and hard on the outside (*mōtōltōl* which also means thick). Before being replanted, the pondfield is again smoothed out (*tasreg*, for the act) and if necessary the walls are repaired (*wos* if a big job and *devun* if small).

Practices used in taro irrigated pondfield systems answer both ecological and social needs. They are remarkably diverse and complex. Along with practices dedicated to the plant, farmers need to master the intricate irrigation technology by building and repairing channels, dams, aqueducts and terraces. One can acquire the knowledge required only by practicing the skills from childhood. Taro pondfields on Vanua Lava exist thanks to the work performed and the knowledge passed on by the ancestors. Farmers of today continue to put into practice traditional knowledge, with the same tools as before. They are taking care of their inherited knowledge, plants and places for cultivation, even if they have access to other techniques, and to less demanding plants such as manioc (*Manihot esculenta* Crantz), sweet potato (*Ipomoea batatas* (L.) Lam.) and macabo (*Xanthosoma sagittifolium* (L.) Schott). The next section will consider why taro is cultivated in abundance.

## 5. PRODUCE TO EXCHANGE

### 5.1. When the Past Serves the Future . . .

On Vanua Lava, walls and canals covered by secondary forest reveal the presence of former



taro water-gardens. This phenomenon has been observed on other islands in Vanuatu. While the taro water-gardens of Hokua and Naturtur, located in the north of Santo, currently measure about one hectare each, they covered four hectares in former times (Galipaud and Di Piazza 2003). According to the people of Vētuboso, the Ōt garden used to be much larger than its current size. These vestiges of ancient taro water-gardens are easily seen near to the borders of Vētuboso territory on the edges of the current systems. Near the upper waterfall of the Bē matwete gēm river, which separates the village of Vētuboso from Kerebetia, I saw further vestiges of taro pondfields. They must have been in service a long time ago as the river from where the water was taken for irrigation canals has now sunk more than 10 metres. The abandonment of taro pondfield systems was certainly due to the large depopulation that affected Vanua Lava. According to Eli Field Malau, 8000 inhabitants used to populate the space around the current village of Vētuboso whereas only nine families was settled there when he was a child (~1950). There are also ancient taro water-gardens on the east coast of Vanua Lava, in the hamlets of Qeso and Lēgirwahag. Vienne (1984: 58–59) also observed vestiges of irrigated gardens that were probably used by small dispersed family units on the east side of the island on the slopes of the Suratamatai volcano. During the 1940s and 1950s, some local missionaries, especially Father Essuva, tried to relocate the population previously dispersed among hamlets in the centre of the island to the east coast at Mētēsarig. There followed a high rate of mortality, attributed to black magic. The people no longer lived on their own lands and thus were prey to all forms of outside attack<sup>10</sup>. It is likely that the missionaries unwittingly introduced several epidemics more easily and more rapidly transmitted in the crowded conditions of a village. The refugees from the coast fled to the West to Vētuboso and Vatrata, and some few individuals left for the islands of Santo, Mota Lava, and Ureparapara. The east coast of Vanua Lava began to be ‘colonized’ by their descendants after the 1980s. A part of the ancient taro water-gardens were turned into coconut plantations, while others were used as mixed gardens, or as areas for the intensive production of kava for a lucrative trade with the people of Sola and Mota Lava.

This architecture of the past is today being put back into service in Vētuboso, by men looking for social recognition in a context of demographic renewal. In effect, the more taro a man has, the more socially valued he will be in the village and even on the island. As stated before, the land for taro is not only inherited, but can also be acquired by asking permission of the custodian *vēnēm* of the abandoned land, where the forest has reclaimed the rights to the ancestors’ pondfields, rivers and swamps. Currently only two families have put old taro water-gardens back into service, by harnessing the water source, cleaning up the irrigation canals, and rebuilding the terraces. Chief Eli Field Malau reclaimed nine terraces at Teñtur, and in 2000 Chief Hosea Waras opened the taro water-garden of Nēlum that he had marked out since 1964. As regards their title, they need to assure themselves of an overproduction of taro that they can distribute regularly, in ceremonies with lots of taro and pigs, in order to maintain or even increase their position. This proud engagement in custom hides other often more practical reasons. Eli Field Malau is thinking of his five sons, whose future needs will greatly surpass the capacity of his currently cultivated pondfields. Hosea Waras has other preoccupations than gaining rank. Married to a woman from a neighbouring island, his children do not have the *vēnēm* of a family from Vētuboso. By opening a new taro water-garden,

**Table 2** Change in the area of taro water-gardens between 1986 and 2002

Taro water-garden	Ōt	Teñtur	Nēlum	Veбал	Rotluō	Bokrat	Total
<b>2003 (ha)</b>	5.9	0.1	0.1	0.4	14.0	0.1	<b>20.6</b>
<b>1986 (ha)</b>	5.7	0	0	1.2	7.7	1.0	<b>15.6</b>

far from possible contesting claims to ownership, Hosea assures the passing down of the land to his children. This example underlines the importance of the *vēnēm* of the mother in the use rights to taro water-gardens.

By comparing the change in form and size of taro water-gardens between 1986 and 2003, using aerial photos and GPS, an agricultural revival is readily apparent. In addition to the creation of Teñtur and Nēlum (+0.2 ha), ancient taro pondfield systems used by the people of Vētuboso, Ōt and Rotluō, have together added 6.5 ha (Table 2). In sum, including a decrease at Veбал and Bokrat of –1.7 ha, the total increase in the surface of taro water-gardens for Vētuboso was 5 ha in 16 years (+13.8%).

Using demographic data from 1979 (west coast), 1989 (by village), 1999 (by village), and 2003 (for Vētuboso), the likely population size of the study sites in 1986, the year of the aerial photos, can be calculated. Thus, the population of Vētuboso increased 22.2% between 1986 (estimated 388 inhabitants) and 2003 (census of 610 inhabitants) while the taro water-gardens only gained in size by 13.8%. The increase in the area of taro water-gardens does not quite match the population increase, and possibly part of the increased demand for food was supplied by a larger number of gardens which are often closer to habitations; in addition manioc, sweet potato, and macabo have become more and more popular because of their ease of growth, precocity, and resistance to drought.

## 5.2. An Overproduction of Taro for Trade

Each household in Vētuboso (with an average of 4.6 eaters, in the 55 households surveyed) plants on average a total of 7.4 units of space: 4.9 in irrigated pondfields, 2.1 in rivers, and 0.4 in swampy areas (Table 3). If all of the taro water-gardens are taken into account (20.6 ha), each person in Vētuboso can potentially plant 338 m<sup>2</sup>. Compared to other areas of Vanuatu

**Table 3** Quantitative data describing taro water-garden production in Vētuboso

	Basin (qēl)	River (mat)	Swamp (boak)	Total/Mean
Number of units of space cultivated per family	4.95	2.07	0.42	<b>7.43</b>
Density (plants/m <sup>2</sup> )	1.97	3.04	1.81	<b>2.27</b>
Weight per corm (t fresh matter)	928.62	1644.21	1430.04	<b>1334.29</b>
Weight per corm (t dry matter)	363.01	670.20	565.12	<b>532.78</b>
Cultivated surface (ha)	9.32	3.74	0.54	<b>13.60</b>
Yield (t fresh matter/ha)	18.29	49.98	25.88	<b>31.39</b>
Yield (t dry matter/ha)	7.15	20.37	10.23	<b>12.58</b>
Annual production (t fresh matter)	170.43	186.94	14.08	<b>371.45</b>
Annual production (t dry matter)	66.62	76.20	5.56	<b>148.38</b>

where taro is planted in irrigated pondfields, the potential of these taro water-gardens is quite large. For example, at Elia on the west coast of Santo, there are 160 m<sup>2</sup> of taro water-garden per person (Walter and Tzerikiantz 1999), and at Hokua in the north of Santo, others calculate 140 m<sup>2</sup> (Galipaoud and Di Piazza 2003).

In the Vanua Lava pondfields, taro is planted less densely (2.0 plants/m<sup>2</sup>; with observation in 57 basins) than on the west coast of Santo (2.5 plants/m<sup>2</sup>) (Walter and Tzerikiantz 1999). The average weight of a corm harvested from a pondfield is 928.6 g fresh, or 363.0 g dried<sup>11</sup>. This is lower than in other studies (average of 1.25 kg in Walter and Tzerikiantz 1999; 1.5 to 2.5 kg in Kuhlken 2002). The yield is 18.3 t/ha fresh, or 7.1 t/ha dried (Table 3), which are comparable to the average yield for Melanesia quoted by Barrau (1958) (15 t/ha fresh). These yields are less than those estimated by Spriggs (1982a) on Maewo (between 35.1 and 58.1 t/ha fresh), by Walter and Tzerikiantz (1999) on Santo (31 t/ha fresh) and by Weightman (1989: 96) for pondfield taro in Vanuatu (between 30 and 40 t/ha fresh). These differences may reflect several factors: collection of samples from more favourable irrigation sites, mulching of fields with plant residues prior to the measurements, optimal climatic conditions, and higher densities of plants than at Vētuboso. For accurate comparisons of yield, dried weights should be recorded, with the same method of drying. It should also be noted that a drought caused by the El Niño after May 2001 could be responsible for the size of the Vētuboso corms, which informants said were “abnormally” small.

The taro grown in rivers did not, on the other hand, suffer from drought. With densities of 3.0 plants/m<sup>2</sup> (measured from two rivers planted with 1485 taros), they weighed on average 1,644 g fresh<sup>12</sup> (670 g dried) after being taken from the water. Thus, the yield of 50.0 t/ha fresh (20.4 t/ha dried) is even greater than that of the continually immersed pondfields on the islands of Maewo and Santo. The cultivation in rivers is even more productive as the growth of the taro is twice as rapid: four to six months is enough as opposed to seven to twelve months in an irrigated pondfield system. The yield in swampy areas lies between that of taro pondfields and rivers, with 10.2 t/ha dry (25.9 t/ha fresh).<sup>13</sup>

Each person in Vētuboso consumes daily 1.09 kg fresh or 0.43 kg dried taro (or 111.18 kilocalories according to the rate of conversion of Walter *et al.* 1999), while a man or woman on the east coast of Santo (Elia, Tasmaté and Wusi) consume 1.23 kg (Walter and Tzerikiantz 1998; Walter *et al.* 1999). The people of Vētuboso as a whole eat 242.7 t of fresh taro, or 95.7 t dried, per year.

Of the 20.6 ha of taro water-gardens currently exploitable, 13.6 ha are cultivated: 9.3 ha of which are irrigated pondfields, 3.7 ha rivers, and 0.6 ha swampy areas. In total, each year, these areas produce 148.4 t of dried taro for the village (66.6 t from pondfields, 76.2 t from rivers, and 5.6 t from swampy areas). This number does not take into account taro produced outside of the taro water-gardens, along isolated rivers, or other swampy areas, nor the taro that dies from disease (37 plants per year per family)<sup>14</sup>, following bad water management (254 plants per family), and/or recurring drought.

The difference of 52.7 t between the taro consumed and the taro produced each year leaves us to believe that a lot of the taro is surplus to local needs. This surplus goes to inter-village consumption via circuits of exchange with other non-producing villages in areas that are too dry, such as Wasag to the south, and Kērēbētia and Mosina to the southeast. Some taro

is also sold at the market at Sola, where government employees have neither the time nor the place to produce taro themselves.

Another important use of taro that has not been included in the calculations is to feed pigs. If a family owns a pig they may cook more taro for themselves and the pig, or additional taro with skin, for the pig. Dogs and chickens also benefit from the waste of non-eaten taro after the meals. However, since pigs are mainly used for exchange purposes, the taro produced in surplus is well invested.

The village feasts and ceremonies constitute another solution for using the surplus taro. Taro, cooked in a stone oven or made into a pudding, *nalot*, is always present on these occasions (Caillon and Lanouguère-Bruneau 2005). The calculation of daily consumption does not take into account these great occasions marking the attainment of a grade, birth of a child, arrival of a stranger, or religious holiday, all of which require assembly of all or part of the village. To sum up, the calculation does not take into account the ‘social generosity’ characteristic of Melanesian societies (Bonnemaison 1991).

## 6. THE TARO WATER-GARDEN, A SOCIAL AND SUSTAINABLE PLACE

The ‘culture’ of taro with alternating irrigation is based on knowledge and exceptional practices that lead to a sustainable and intensive agriculture in a socially-valorised place where men love to show off their abilities to grow taro. Despite a lower yield compared to rivers and swamps, cultivation in pondfields irrigated in alternation, possibly unique within Vanuatu and the Pacific generally, is the most socially valorised technique in the village. Taro from irrigated pondfields is the pride of the men and women of Vētuboso, of those who “know how to work” (Eli Field Malau, Vētuboso, 2002). A man who farms a large number of terraces according to ancestral rules will be remarked upon and admired for his work. Sharing his taro with the other members of the community gives a farmer an opportunity to have his expertise recognized and appreciated, and thus to expose his virility (Kahn 1986).

While the two other systems of cultivation need no maintenance, irrigated taro pondfield systems require constant work based on knowledge transmitted from generation to generation. The requisite knowledge covers different domains, such as the maintenance of canals, terracing, the consolidation of walls and dikes and irrigation control. The pondfield systems require ecological knowledge about the use of plants that keep pests away, as well as social knowledge that may include the use of customary practices, taboos and magic. While taro left alone in rivers and swamps can survive and reproduce, those planted in pondfields need to be cared for in order to continue to thrive after each cultivation. A farmer inherits his horticultural knowledge according to his kinship ties, knowledge being passed down along cognatic lines. Thus, taro embedded in its pondfield is socially valued as the carrier of the memory of the ancestors and a window into the knowledge of individuals.

Agriculture on Vanua Lava was born of the gift of the combination of taro, pondfields and water, for which the mythic hero of the island, Lakakēris, was responsible. The taro water-garden, along with its practices, is an ancestral cultural place; the “Black man” established it and the “White man” has changed nothing.<sup>15</sup> Since its time of origin, this civilization could always grow by multiplying taro plants and water-gardens, certainly up to the period of

demographic decline brought about by the pressures of colonization. Today, the farmers of Vētuboso not only continue to practice what has been inherited from their ancestors, but also reclaim former taro water-gardens even if production and consumption calculations prove that taro is being produced in surplus quantities. The need to feed their exchange networks coupled with demographic growth forces families to push back the boundaries of existing taro water-gardens or to re-open old ones, where the hero and the ancestors had formerly made canals and planted taro. It is a re-appropriation of the glory of the ancestors and thus the memory of the island. The taro water-gardens of Vanua Lava also offer a considerable food potential for the population of today and tomorrow.

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### NOTES

- 1) These authors describe other systems as well but these are not found on Vanua Lava. In Micronesia and on the atolls, giant water taro (*Cyrtosperma chamissonis*) is grown in pits; in areas such as in Papua New Guinea (PNG), Cook Islands, Wallis Island and elsewhere, in mounds surrounded by a network of drains (island bed); and only on Aneityum Island (Vanuatu) in furrows.
- 2) All names in Vurës have been checked in the Vurës lexicon (Malau 2011).
- 3) Some taro water-garden names corresponding to proper names, for example Ōt, have not been translated.
- 4) *Ro* is the feminine prefix; *vōnōlav* is the term in Vurës to designate the Island of Vanua Lava, meaning “large inhabited place”.
- 5) The daughters retain use rights in their brother’s land. If there are no sons, the daughters can inherit their father’s land.
- 6) Although previously forms of irrigation were practiced elsewhere in the Banks Islands on Gaua, Motalava and Ureparapara islands (Ward 1979), on Tanna (Kwamera district) and Erromango (Rivers 1926: 267), on Malakula (Deacon and Wedgwood 1934: 177) and on Efate (Matthew Spriggs, pers. comm.). On Aneityum, along with island beds in swamps, canal-fed furrow irrigated gardens allow an abundant production of taro (Spriggs 1982a; Spriggs 1982b). For the rest of Oceania, other articles provide a good synthesis (Denevan and Turner 1974; Klee 1980; Kuhlken 2002; Spriggs 1990).



- 7) All the taro pondfield systems have a single source of water, except for Ōt, which has two.
- 8) I did not try to obtain such knowledge. However, one informant recalled with humour the time a student tried to push him to reveal the names of these leaves. He only told the student one out of three, making the cocktail inactive. Often when one talks of magic the informant will keep secret a step or an ingredient of the procedure to avoid someone else gaining this knowledge.
- 9) In rivers and swamps, the extreme end of the corm is immediately replanted between the stones or in the mud once the taro is harvested. This individual planting practice at separate times allows a harvest spread out over the entire year.
- 10) It is said that people killed by using a blowgun to project magic herbs over a great distance. It was thus necessary to hide oneself in the forest and light fires only at night to avoid being found out by the smoke.
- 11) The average weight of corms is calculated from 188 taro plants (11 cultivars) after removing their roots and soil residue. The calculation of dried weight was made after drying sliced corms at 40°C for three days using a plant drying oven.
- 12) The average weight of corms was calculated from 35 corms harvested in March 2002.
- 13) With an average corm weight of 1,430 g fresh, or 565 g dried, and a density of 1.8 plants/m<sup>2</sup>.
- 14) Average calculations from a questionnaire filled out by 56 people.
- 15) Apart from being indirectly responsible for the abandonment of certain taro water-gardens due to depopulation following introduced disease.

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