Myanmar can be divided into different agricultural regions according to their natural and socio-economic conditions and characteristics. It would be too simplistic to distinguish agricultural regions primarily on the basis of natural conditions. The wide range of very disparate socio-culturally determined, mostly 'traditional' agricultural forms creates a highly differentiated picture. Thus, for example in Chin, Kachin and Shan States different cultivation methods and traditions, different agricultural products, crop sequences and specialisations are to be found, simply because of the different ethnic groups in these regions. Also to be taken into account are diverse historical influences. The structural patterns of agriculture that evolved in the pre-colonial period were altered during the British colonial period, when agriculture was expanded across the country and hitherto untouched natural landscapes were systematically developed.

The differentiation of eight agricultural regions was derived from a synthesis of several criteria, based on primary and secondary data as well as qualitative characteristics (Kraas 2015): a) topography/relief (based on topographic maps and satellite images), b) total annual precipitation (data from the Department of Meteorology and Hydrology Myanmar), c) current land-use and vegetation (based on global land cover data; Chen et al. 2014), d) official agricultural statistics from the Ministry of Agriculture and Irrigation, e) numerous interviews with public authorities, entrepreneurs and farmers in the states and regions of Myanmar, f) field observation. Based on these criteria, eight different agricultural regions can be distinguished which shall briefly be characterised.
COASTAL REGIONS

Along the coast, the dominant activities are fishing and gathering (marine animals, seafood and firewood; Heymann/Löffler 1997) in the adjoining brackish areas with frequently relatively untouched mangrove, nipa and bamboo forests. The agricultural potential along the coast is low, especially as the workforce is already seasonally occupied in fishing and tourism in a few places with early tourism development. Wet rice cultivation is mostly practiced for subsistence in the elongated coastal marshes beyond the beach walls, often together with vegetable cultivation for local markets.

DELTA AREAS OF THE AYEYARWADY, SITTAUNG AND THANLWIN RIVERS

The intensively cultivated southern Ayeyarwady Delta is the core of Myanmar’s agricultural production today (Adas 1974, Nishizawa 1991, Brown 2005, Hedley/Bird/Robinson 2010). This is the ‘rice bowl’ of the country, with extensive cultivated areas only a few metres above sea level, covering an area of over 20,000 km². Also rain-irrigated wet rice cultivation, pulses and vegetables are grown. Often, elongated houses on stilts for hens and ducks are erected in the basins, providing important extra income. Where storage reservoirs, dams and canal system enable irrigated farming outside of the rainy season, up to three harvests are possible. The potential of artificial irrigation is considered to be underutilized (Kraas 2016b).

The specialized cultivation of fruit – pomelos, watermelons, mangoes, durian or jackfruit – diversifies agricultural income. While most agricultural products in the deltas are produced for the national market, the export share of fruit and especially fish and prawns (dried or increasingly fresh-chilled) to Southeast Asia, China and Japan is rising continuously.

In areas easily accessible from Yangon and Mawlamyine and along the now well-developed trunk roads, e.g. to Maubin and Pathein, traditional tillage is increasingly being displaced by capital-intensive aquaculture, often owned by foreign investors (from Japan, Vietnam, Thailand) or joint ventures.

Following the devastation caused by Cyclone Nargis in 2008 (Kraas 2009), numerous reconstruction and development aid projects have led to the modernisation and mechanisation of agriculture in the Ayeyarwady Delta.

SOUTH CENTRAL MYANMAR

As precipitation and population densities decline northwards, rice accounts for a falling proportion of the harvest, and its yield levels drop. Oilseeds (sunflowers, peanuts, sesame) and cotton are increasingly cultivated. The share of sorghum and pulses – various peas, lentils, beans – rises, whereby the high diversity of the endogenous crops cultivated, many of them still very widespread, indicates how strongly Myanmar’s agriculture has been oriented towards the domestic market and its demands for many decades. Systematic and improved processing, marketing and quality improvement would enable a rise in farmers’ incomes and at the same time help to develop agroindustry.

THE DRY ZONE OF CENTRAL MYANMAR

In the dry zone of central Myanmar, which lies in the rain shadow of the major mountain ranges and receives between 400 and 1,000 mm annual precipitation with up to seven arid months, generally only dry farming is possible. As well as various species of acacia, the natural vegetation includes dwarf shrubs and succulents; some animals are kept where these grow. The main dry zone crops are peas, maize, cotton, sesame, onions and chillies (FAO 2005). Palm sugar production (toddy palm) attracts seasonal labourers from all around the country.

Apart from the irrigation zones near the Ayeyarwady River and its tributaries, where up to three harvests are possible, the potential for artificial irrigation has so far not been exploit-
ed systematically. However, it should also be borne in mind that agriculture competes with urban employment opportunities in the Mandalay agglomeration, and the expansion of irrigation would have ecological consequences for the lower reaches of the Ayeyarwady River.

VALLEYS OF NORTH CENTRAL MYANMAR AND KACHIN STATE

In the broad fertile valleys of the Chindwin and Ayeyarwady Rivers with annual precipitation levels between 1,000 and 3,500 mm, sugar cane, rubber, oil palm, potatoes and mustard plant are cultivated as well as the dominant rice. Linked to the relatively low population densities, cultivation is less intensive than in the south of the country. The formerly widespread subsistence agriculture has changed since the late 1980s with the ongoing improvement of transport routes, although the north of the country remains poorly connected to the central lowlands. During the dry period, subsistence rice and vegetable cultivation is practised on the sandy islands and sloping banks of the large rivers. For some years harvested crops have increasingly been sold to Yunnan/China, as well as to India via the border crossing at Tamu or Rihkhawdar. The choice of plants cultivated (e.g. maize, yams, citrus fruits) has also changed in response to the growing demand from neighbouring countries for food and animal feed.

In principle, there is considerable potential for intensification. However, in view of the numerous nature reserves and conservation potential, the opening up of new areas to agriculture is questionable. As the region is thinly settled and many workers are already employed in extensive mining activities, there is currently little pressure to expand agricultural land-use.

MOUNTAINOUS REGIONS (BAGO YOMA, RAKHINE YOMA, CHIN STATE, NORTHERN SAGAING REGION, KACHIN AND SHAN STATES)

The highly differentiated mountainous regions of Myanmar, reaching heights between 2,000 and 4,000 m, with a high relief energy in Chin State and a somewhat lower relief energy in the Shan Hills, form numerous parallel mountain chains running north-south, composed mostly of limestone and granite.

Flatter slopes are usually cultivated as clearances. Slash-and-burn cultivation often occurs on the slopes in the typical Myanmar Taungya cultivation, where the fires are controlled and selected tall trees, so-called legacy trees, are
left standing in the course of clearance in order to support reforestation after two to three years of agricultural use. Shortly before the onset of the monsoon, mostly rice, sorghum, soya and maize are sown directly into the ashes. As yet there are few areas with permanent crops such as fruit trees, tea or coffee, as so far there is a lack of agricultural techniques and knowledge, capital and a functioning marketing system to encourage permanent crops.

Also grown are wheat, potatoes, vegetables, maize, onions and garlic. The intensively farmed permanent crops on the flatter slopes include fruit (apples, grapefruit, grapes, pineapples and strawberries), macadamia trees and above 1,500 m coffee and tea, usually in the form of plantations, which were initiated during the British colonial period. Furthermore, at higher elevations the cultivation of medicinal plants (castor oil plant, ginger or cinnamon), tobacco and traditional spices is expanding. Currently, these are mainly sold on the domestic market for traditional medicine or local specialities and are rarely subject to specific quality controls. On sunny slopes near Taunggyi, viticulture is now successfully practised in a pioneering venture.

In particular in the mountains around Inle Lake and along the long-distance roads from Thazi via Kalaw to Taunggyi and from Pyin Oo Lwin via Hsipaw to Lashio and Muse, the cultivation of mid-latitude crops has expanded considerably in recent years, since the growing demand in urban and (seasonal) tourism centres can be met thanks to improved transport links (Nilar Aung 2007). Near mining cities (e.g. Mogok, Kyatpyin or Hpakant), agriculture is in competition with mining so that with the availability of more capital, more intensive forms of cultivation have developed, e.g. slope cultivation with furrow irrigation or localized irrigation, greenhouses, partly with seasonal labourers.

Many coastal mountain ranges (large parts of the southern Rakhine Yoma and the mountains parallel to the coasts of Mon State and Tanintharyi Region) are subject to increasing land-use pressure, whereby rubber plantations, and in the south oil palm plantations, dominate.

In many mountain regions there are large national parks with a high biodiversity of flora and fauna, including wild elephants (protected since 1879), tigers, rare species of deer and a large number of bird, reptile and amphibian species, some of them endemic. There are also numerous nature reserves where subsistence agriculture is permitted. These protected areas are a tremendous resource for the country insofar as their natural flora and fauna have hitherto been little influenced by human land-use. An expansion of agriculture in these regions is possible and conceivable, but is not very feasible in respect to the significance of their ecological potential.

BASINS AND VALLEYS OF THE MOUNTAIN REGIONS

Within the mountain regions, numerous basins and valleys facilitate more intensive farming than on the hill slopes. Because of the altitude-related lower annual average temperatures (under 18°C), with lowest temperature values just above freezing point at high altitudes, mid-latitude vegetables and fruit are cultivated. Some of these were introduced during the British colonial period, while many were brought to the country by missionaries in the context of aid activities to improve basic nutrition: potatoes, cabbage, tomatoes, cucumber, carrots, radishes, celery etc. Since 1988, the influence of China and Thailand has been apparent, especially in the Shan Hills: Traders import seeds which produce higher yields and better-looking crops, although these often prove less resistant to plant diseases and pests than local varieties. For this reason, local seed providers have become established in recent years. Through the connection to Thailand, and increasingly also to China and India, increasing amounts of pesticides and artificial fertilizers are being applied in agriculture, so that the special potential of relatively unspoiled soils which could be used for organic farming, is gradually dwindling.
High-yielding agriculture is primarily practised at an altitude of about 900 m in the Shan Hills and around Inle Lake, Myanmar’s second largest inland lake. Traditionally, so-called ‘floating gardens’ (Wilhelmy 1986) are created on the lake: On artificial islands and earth-covered mats anchored in the lake floor with woven roots and climbing plants as well as wooden posts, lake sediments and plant detritus are repeatedly deposited to expand and deepen the soil layer. The main crops on these islands are tomatoes, beans, onions, leeks, aubergines and flowers. The constant supply of water from the lake makes several harvests per year possible. The cultivation and harvesting of the elongated ‘fields’ is effected from boats that access the plants along narrow canals and transport the harvested crops. On the lake banks the crop is sorted, packed and then transported, mostly by truck, to the agglomerations of Yangon and Mandalay (Nilar Aung 2007).

HIGH MOUNTAINS

The mountain regions above 2000 m in the north of Kachin State have hitherto been quite inaccessible because of a lack of transport links and are only used for agriculture in scattered locations. The mountain massifs of the eastern foothills of the Himalayas surrounding the country’s highest mountain Hkakabo Razi are largely inaccessible. The dense mountain rainforests at lower altitudes with oaks, chestnuts, tree ferns and bamboo, pines and rhododendrons give way to open bush- and grasslands at higher altitudes. Subsistence agriculture is carried out mainly in the valleys, sometimes on terraces, with rice and vegetable cultivation dominating. Taungya slash-and-burn cultivation is practised sporadically, making dry rice cultivation possible. Hunting and gathering are also common in the forests, though limited in many places by local restrictions on their use.

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