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Ensuring food security in the small islands of Maluku: A community genebank approach



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Abstract As a province composed of hundreds of small islands, Maluku is highly susceptible to decreasing biodiversity of plant resources for agriculture. Pressures from pests and disease infestations, difficulty of seed storage, market demands for specific cultivars, and the introduction of new superior varieties are decreasing crop and plant genetic diversity and will impact the food security in the islands. The establishment of community genebanks is proposed to ensure the continuing existence of plant genetic resources and thus the food security of the islands of Maluku Province. The development of facilities and training of personnel to support the survey, collection, and conservation of materials is required, in part to facilitate their cycling of the crop/plant materials to farmers in need. Also required is the study of role and the problems faced by farmers in order to propose supports for bio-diversity that maybe sociological as well as technological.

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Introduction

Food security has become a concern throughout the world due to the prevalence of food scarcity in many different areas. The Food and Agricultural Organization (FAO) reports progress in achieving the Millennium Development Goals at the targeted year of 2015, specifically for the first goal to “eradicate extreme poverty and hunger”. The data showed that in

developing regions, the proportion of people living on less than \$1.25 a day fell from 47% in 1990 to 22% in 2010. About 700 million fewer people lived in conditions of extreme poverty in 2010 than that in 1990. As well, the proportion of undernourished people in developing regions decreased from 23.2% in 1990–1992 to 14.9% in 2010–2012. However, one in eight people in the world today still remain chronically undernourished (Wu, 2013).

The United States Agency for International Development (USAID) (2013) has further indicated that in order to meet the needs of a world population which is expected to reach 9 billion by 2050, agricultural production will need to increase by at least 60%. With the present scarcity of resources, there needs to be a more efficient way to fulfil this demand. Ensuring that people have sufficient food requires aligning short-term

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assistance with a long-term development strategy which will help countries feed their own people. Data released by the Indonesian Central Bureau of Statistics placed Maluku Province as the third most impoverished among all provinces in Indonesia during the years 2008 and 2009 (Badan Pusat Statistik, 2009). According to the data almost 30% and over 28% of the Malaccan population lived in poverty in the years 2008 and 2009 respectively. This data implies that even though much progress has been made, significantly more effort still has to be made to improve the living standard of the Malaccan.

The development of Maluku Province in order to attain the goals of the Provincial and National Development Plans, as well as Millennium Development Goals concerning the eradication of poverty, is closely related to the availability of plant genetic resources for agricultural practices. The richness of plants (cultivated crops and wild relatives) as well as animals and marine biology in Maluku has been well known for centuries; many of these components of biodiversity are unique and can only be found in this region. This biodiversity has been exploited for the economic improvement of the community in this island province. However, being a province comprised of a great number of small and medium size islands which are characterized by mountainous and hilly topography and low agricultural land availability, Maluku is ecologically susceptible to the erosion of plant genetic resources – that is the irreversible and irreplaceable loss of genetic resources specifically for agriculture. Studies conducted by comparing the reports of past surveys with present observations, as well as through information provided by the community agricultural leaders indicated a tremendous loss of plant genetic resources of various agricultural crops in the islands. This loss of agricultural plant genetic resources, which have supported the life of the islands' community, will have an impact on the food security of the community on the islands. This process arises, in part, through processes of globalization; pressures arising from climate change are likely to create an even more urgent situation. The objectives of this paper are, therefore: to describe the diversity and loss of genetic resources, especially for agriculture in the small islands of Maluku; to explain the causes of the germplasm loss and discuss its impact on food security; to propose possible solutions for the maintenance of the crops/plants germplasm and for the improvement of food security in the small islands of Maluku.

Methods

The studies were conducted in several ways and in several locations (Fig. 1). Studies in the islands of Kisar, Leti and Moa were accomplished through a visitation accompanied by a member of the parliament from the Maluku Province. Data collection was completed by questioning a number of farmers using a questionnaire, and then field interviews. Data collection was followed by discussion with the community leaders in the islands. Studies in Ambon and surrounding islands were accomplished by field work and direct observation by the author (SL) and the students of the Pattimura University, Ambon. Data collections were done by interviewing the farmers' groups, extension service personnel of the provincial government, and field and market visitations and observations. Studies in the Ceram, Saparua and Yamdena islands

(specifically of tuber crops) were accomplished through participation in the project of "Crop Potentials of Underexploited Tuberous Yams and Aroids", a joint project between the United States Agency for International Development (USAID) (2013) and the Pattimura University, Ambon, Indonesia. Data collection was done through surveys of the agricultural institutions at the regency/village levels, followed by field visits which included collection of samples.

Familiarity with genebanks was accomplished through participation in an advanced training on the "Utilization of Plant Genetic Resources as a Contribution to Food Security" (*Nutzbarmachung pflanzengenetischer Ressourcen als Beitrag zur Ernährungssicherung*) in Germany (Leunufna, 2010a). Training included lectures, seminars, and participation in the field work of the genebank at the Institute for Plant Genetics and Crop Plant Research (*Institut fuer Pflanzengenetik und Kulturpflanzenforschung-IPK*), Gatersleben, Germany and visits to other genebanks including that of Arche Noach in Wien, Austria.

Results

Some of the diversity and uniqueness of the genetic resources in the small islands of Maluku can be seen in Figs. 2 and 3. The Savanna ecological area has a micro-climate specific to the South West South Maluku Regency (Kabupaten Maluku Barat Daya – MBD) of Maluku Province. It is the habitat of Moa buffalo (*Buballus buballus* L.), and includes the dry climatic condition (agroclicmatic zone of C3 with 5–6 wet months and 4–6 dry months, and zone D3 with 3–4 wet months and 4–6 dry months. In combination with other environmental factors, this has provided a habitat and niche for the presence of koli palm (palmae), Kisar orange (*Citrus* sp.) as well as other unique species including Kisar sheep (*Ovis* sp.) and Leti goat (*Capra* sp.), which are present only in the region (see Oldeman and Las, 1980).

In terms of food crops, corn (*Zea mays* L.) has been the main crop; judging from the variety in color of seed endosperm alone, there are a number of cultivars present. It is cultivated in a multiple cropping system with other food crops such as cassava (*Manihot esculenta* L. Crantz), cucurbits (Cucurbitaceae), and peas/legumes (Leguminosae). Other food crops which are also found include ground nut/pea nut (*Arachis hypogaea* L.), bean (*Phaseolus vulgaris*), yams of the species lesser yam (*Dioscorea esculenta* (Lour.) Burkill), breadfruit (*Artocarpus altilis* (Parkinson) Fosberg) of two cultivars, one with the round fruit shape and the other with an elliptical fruit shape.

Influenced by the climatic condition of a long wet season (agroclicmatic zone of B1 with 7–9 wet months and less than 2 dry months, and zone C1 f with 5–6 wet months and less than 2 dry months, Oldeman et al., 1980), diversity of plant/crop genetic resources in Ambon and the surrounding islands of Ambon Municipality (Kota Madya Ambon), Central Maluku Regency (Kabupaten Maluku Tengah), West Ceram Regency (Kabupaten Seram Barat) and East Ceram Regency (Kabupaten Seram Timur) seemed to be greater in comparison to that of South West South Maluku Regency. Some of this diversity can be seen in the diverse commodities present in Ambon city traditional markets (Fig. 3).

Food crops mainly found in this region include Sago (*Metroxylon sagu* Rottb.), various cultivars of Cassava, banana and plantain (*Musa* spp.), species and cultivars of

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