# Tackling Wicked Problems in Indonesia:

# A Bottom-Up Design Approach to Reducing Crime and Corruption

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## ABSTRACT

This paper describes how a social entrepreneur in Borneo launches a bottom-up change process to tackle wicked problems. The results of the change process to date have been remarkable: the regeneration of forest areas and habitats for endangered species, the redesign of communities and their local economies to support the forests and habitats, the reduction of crime and corruption, and changes in the climate which have generated much-needed rainfall in the area. In contrast to Indonesia's top-down initiatives, this bottom-up strategy illustrates how the empowerment of the local people can produce dramatic results.


## INTRODUCTION

Policy planners coined the term "wicked problems" to describe a certain type of problem they confront with greater frequency. Originally defined as a problem that was difficult to solve because of incomplete, contradictory information and design parameters (Churchman, 1967), Horst Ritell and Melvin Webber (1973) further refined the term to describe problems that cannot be definitively described nor definitively and objectively answered. Drawing on the policy literature, they elaborated on what they saw as their basic characteristics: 1). There is no definitive formulation of the problems; 2). There is no stopping rule to determine when they are solved; 3). Solutions are not true-or-false, but good-or-bad; 4). No ultimate test of a solution to a wicked problem exists; 5). There is no opportunity to learn by trial-and-error since every attempt counts significantly; 6). No set of potential solutions exists nor are there criteria to establish that all solutions have been identified and considered; 7). Every wicked problem is unique; 8). Every wicked problem can be considered to be a system of another problem; 9). An analyst's world view is the strongest factor in explaining which solutions are favored and promoted to resolve a wicked problem; and 10). The planner has no right to be wrong.

Wicked problems have been appearing with greater frequency on the policy agenda—climate change, corruption, unemployment, national debts, recessions, terrorism, ecological degradation, water and food shortages, lack of heath care, etc. Although governments and policy makers have launched efforts to cope with these problems, many concluded as had others before them, that wicked problems were indeed intractable (Ackoff, 1974; Conklin, 2006; Horn and Webber, 2007). Others however disagree. They strongly believe that with entrepreneurship, innovation, and a different approach to change, it is possible to tackle wicked problems. Rather than taking a top-down approach reliant on policy experts and lawmakers, they propose launching collaborative, grassroots change from the bottom up. We have come to call them social entrepreneurs (Bornstein, 2007; Praszkier & Nowak, 2011) and this paper documents the efforts of one of them—Willie Smits of Borneo, Indonesia.

The paper is divided into five parts. Section two provides a brief summary of the many approaches to problem solving in wicked problem territory and introduces the design approach which has gained traction of late. Section three provides a detailed case description of Samboja Lestari where Smits and his collaborators launched their redesign work. Results follow in the section four. We find some startling progress: the regeneration of forest areas and habitats for endangered species, the redesign of communities and their local economies to support the forests

and habitats, the reduction of crime and corruption, and changes in the climate as a result of the regenerated forests that have added much-needed rainfall.[1] Section five concludes the paper with some implications of the design approach for tackling wicked problems, especially those concerned Indonesia's timber industry and endangered species. The *direct approach*, reliant on top-down, government-initiated, internationally-funded interventions that primarily focus on infrastructure development to bring high-profile perpetrators to jail and recover stolen assets, may not be the only way to fight crime and corruption. Smits illustrates a bottom-up, indirect effort that empowers local people and makes crime and corruption less likely to occur in the first place.

## DESIGN APPROACH

People have evolved a number of techniques over the years to address their wicked problems (Conklin, 2006; Ackoff and Rovin, 2003; Roberts, 2000). We can ignore the problem and hope it goes away. We can "assert that the problem is solved" (Conklin, 2006, p. 21) as when we are trapped in wars we cannot win "just declare ourselves the winner and go home." We can give up trying to get a good solution—"just follow orders, do your job, and try not to get into trouble" (Conklin, 2006, p. 22). We can pass the problem on to others and blame them for the mess (Conklin, 2006, p. 36). Alternatively, we can collect more and more information to analyze—what is referred to as "analysis paralysis." We also can "muddle through" (Lindblom, 1959) and "satisfice" (Simon, 1957) or when all else fails, we can just "go with our guts" or "just use our common sense." These and other shortcuts are illustrative of five general approaches to problem solving: use of Authority, Competition, Science, Engineering and Technology, Taming, and Design.[2]

Each problem solving approach has been attempted and each has its limitations. One approach that shows some promise is the design approach. Although no single definition of design exists, most consider it a data-driven, collaborative problem solving process that invites people who 'live' with the problem to frame it, establishes the parameters and constraints of the solution search, identifies creative ideas as solutions, rapidly prototypes and tests solutions in the field, collects feedback, and reframes problems and solutions wherever the data-driven process (not ideology) leads. Or as Buchanan (1992) summarizes, it is "the systematic approach to the invention of possibilities" (p. 13). The key is to think of design as a system of three overlapping spaces, not a sequence of orderly steps (Brown and Wyatt, 2010). In the inspiration space, the problem or opportunity motivates the search for new ideas as potential solutions. In the ideation space, one generates and develops new ideas. And in the implementation space, new ideas are prototyped, tested, iterated and refined (Brown and Wyatt, 2010, p. 33) in order to uncover unforeseen challenges or unintended consequences and to ensure that solutions will have more reliable, long-term success.

At its core, design is "a human-centered approach to problem solving, or what some have referred to as the "return of human beings to the center of the story" (Brown, p. 39). The

[1] Willie Smits, Saving Rainforests, http://poptech.org/popcasts/willie_smits_saving_rainforests; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[2] This section on alternative approaches to problem solving has been deleted due to space limitations.

emphasis is on "fundamental human needs" (p. 19) and it requires creatively navigating among competing constraints of "what is technologically feasible and economically viable without losing sight of what is humanly desirable (Brown, 2009, pp. 15-21). Attempting to balance the competing claims of technology, economy, and humanity, design builds on eight principles that distinguish it from other modes of problem solving. Design is: change oriented; holistic; integrative; 4). collaborative; 5). leader activated and orchestrated; 6. research reliant but not research constrained; 7). embodied; 8). And action oriented. Each of these design characteristics will be explored in greater depth when analyzing the case of Samboja Lestari below.

## CASE STUDY

This research relies on a case study of a social entrepreneur, Willie Smits, who first uses a design approach to tackle the wicked problems of species and plant extinction and deforestation. In creating a collaborative network of community members, businesses, and government agencies, his design interventions had second-order consequences in Samboja Lestari, Indonesia—the regeneration of community life, the reduction of poverty, crime, and corruption, and the increase of rainfall that changed the climate in the entire region.

Samboja Lestari is about 25 miles from the port city of Balikpapan in East Kalimantan, Borneo, Indonesia. Originally a rainforest, it was founded about a century ago when oil was discovered in the area and the forest had to be cleared for oil workers. Its story is a common one. Wood cutting accelerated in the 1950s as people flooded into the booming oil town of Balikpapan, roads were built, and loggers felled the dipterocarps for the valuable hardwood lumber. The deforestation left Samboja Lestari vulnerable in the years that followed. Dry periods opened up coal seams just beneath the surface to the air which resulted in CO2 emissions and fires. In addition, the tribal slash and burn techniques, used as a way to fertilize the land, set off a series of fires in 1997 and 1998 in the productive land. The flames spread, burned for weeks and months, and destroyed about 10 million hectares or 38,600 square miles of Indonesia's national forests (Barber and Schweithelm, 2000). According satellite images, the entire region was enveloped in smoke which drifted on to Timor and billowed west leaving 30 cities in Indonesia shrouded in smoke with more than 1,000 hotspots of flames racing up hillsides.[3] [4] The fires released up to 40% of the total carbon dioxide emissions worldwide that year (Page et al., 2002). Then in 1982 and 1983, due to El Nino, firestorms ravaged the area and destroyed the small pockets of remaining forest. "Between 1985 and 2005, all of Borneo lost a swath of rainforest the size of Florida."[5]

By 2002, droughts brought crop failures in Samboja Lestari and an almost total extinction of plant and animal life so that the land no longer could sustain agricultural productivity.[6] Flooding

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[3] Little, J.B. Regrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[4] Indonesian Fires 1997-1998, http://www.oocities.org/capitolhill/congress/5126/sat2.html; Total Ozone Mapping Spectrometer, http://toms.gsfc.nasa.gov/aerosols/indonesia/indonesia.html; Satellite Images of Vegetation Fires in Sumatra, Indonesia, http://www.crisp.nus.edu.sg/coverages/fires/index.html

[5] Little, J.B. Regrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[6] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

occurred five or six times a year. Combined with annual fires, it prompted the growth of alang-alang grass that produces hydrocyanic acid that prevents the germination of tree seeds. To date, deforestation has continued and even has accelerated due to the construction of oil palm plantations for the sale of biofuels. A secondary effect of the deforestation is the exposure of some twenty meters of peat swamp forest, the largest accumulation of organic material in the world. When opened up for growing oil palms, the peat swamp creates "volcanoes of CO2" that make Indonesia, without any industry, the third largest emitter of greenhouse gases after China and the United States.

The ecological disaster took its toll on human population.[7] Samboja became the poorest district of East Kalimantan with almost 50% unemployment and a high crime rate. Poor nutrition, respiratory problems and hygiene-related health issues drove life expectancy rates low and infant and maternal mortality rates high. Almost a quarter of average income went toward the purchase of drinking water. People began to hunt orangutans to eat, trade and sell to tourists, or just kill them which reduced their numbers by 50%.

Willie Smits entered wicked problem territory through a chance encounter with a caged and dying orangutan discarded in a garbage heap.[8] Taking her home, he nursed her back to life. His solution to the endangered orangutans was to found the Borneo Orangutan Survival Foundation (BOS)[9] in 1991, a nonprofit organization dedicated to the orangutans and their habitat. The goal was to establish a way station to rehabilitate and protect them until the deforestation stopped and they could be returned to the remote woods. "I thought I could save orangutans—put them back in the forest and everybody would be happy. It was a beautiful dream."[10] But Smits finally had to face the fact that his efforts to protect them in Borneo's existing rain forests were failing. Forest destruction was relentless: nearly two million hectares a year were taking some 3,000 orangutans with it.[11]

Learning from his efforts to save the orangutans, Smits decided that the only way to save them was to re-create a rainforest and the only way to do that was to get the local community invested in its creation and protection. He began with 100 local workers and expanded to include 600 families of the local Dayak tribe in the Indonesian province of East Kalimantan.[12] He came to understand that saving the environment also meant addressing local people's needs.

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[7] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;
Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[8] Willie Smits, Orangutans in Danger, http://forum-network.org/lecture/orangutans-danger;

[9] BOS Foundation, http://www.sambojalodge.com/AboutBOSFoundation/
Borneo Orangutan Survival, http://savetheorangutan.org/splash.html;
Learning to give, http://learningtogive.org/papers/paper247.html;
BOS Foundation, http://www.sambojalodge.com/AboutBOSFoundation/

[10] Little, J.B. Regrowing Borneo Tree by Tree, , Scientific American, December, 2008, 64 – 71.
http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[11] Little, J.B. Regrowing Borneo Tree by Tree, , Scientific American, December, 2008, 64 – 71.
http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[12] Little, J.B. egrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71.
http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

So how does one re-create a rainforest to meet people's needs? The project began in 2001 with the purchase of land near Samboja. BOS began buying land around the Dayak village and paying villagers what Smits considered to be a generous price.[13] In 2003, BOS purchased 1,200 more hectares (4.6 sq. miles), most of it through credit from the Gibbon Foundation (also under Smits' management). To sustain the financing, BOS subsequently launched the "Create a Rainforest" initiative where donors could symbolically adopt square meters of rainforest and review the progress of their contribution using Google Earth satellite images to compare data from 2002 with current data on the reforestation project.[14]

Smits' next step was to create a three-hectare nursery using seeds he had collected from more than 1,300 species, some from orangutan feces. But since the soil was infertile, low in nutrients, and choked with "hard as steel" plinthite clods, soil preparation was imperative to give the seedlings a chance of survival. Drawing on his doctoral dissertation on mycorrhiza and his background in microbiology, Smits started making compost. He mixed organic wastes, sawdust, fruit remnants from the orangutan cages, manure from cattle and chickens from his other projects in Kalimantan, and a special microbiological agent made from sugar and cow urine. Thanks to the humid local climate, each batch of compost was ready every three weeks.[15]

Next, Smits and his partners began planting trees, but not just any trees. They planted Acacia mangium and other fast-growing trees to restore the microclimate for later species, provide soil protection and to provide shade to kill off the alang-alang grass that secrets cyanide from its roots. They also added special fungi that breaks down the grass and provides important nutrient pumps to provide critical bacteria and microorganisms. Beneath the fast-growing trees, they planted primary, slower-growing rain forest trees. In between the trees, they planted agricultural products—pineapples, beans, ginger, and corn, and in a second phase papyrus and bananas, and in the last phase chocolate and chilies, to reduce the competition and add crop fertilizers for the trees.[16]

In all, the 2,000 hector forest is divided into three zones.[17] [18] The outer zone is a 100 meter wide ring of sugar palms which serves as a fire protection—sugar palms do not burn easily—and they also are flood resistant. A fence of thorny palms separates the fireproof ring from the reforestation zone in the middle which is dedicated to water harvesting and conservation. It also serves as a barrier to protect the wildlife within its boundaries. Here, in the heart of Samboja

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[13] Little, J.B. Regrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[14] Create a Rainforest, http://www.createrainforest.org/en/idea;
Samboja Lestari, Part 1, http://www.youtube.com/watch?v=pWAirgXwiI4

[15] Thompson, S. Borneo Experiment Shows How Saving the Apes Could Save Ourselves, This Magazine, May 17, 2010, http://this.org/magazine/2010/05/17/apes-saving-humans/

[16] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;
Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[17] Little, J.B. Regrowing Borneo Tree by Tree, , Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[18] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;
Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

Lesteri, grows a wide variety of trees selected for their benefits to the wildlife. Sugarcane, papya and lemon trees feed the orangutans, birds and other wildlife. The third, innermost zone, around 300 hectors, has been set aside for activities supporting the emerging rain forest: arboretum and forest research facility, sanctuaries for captive animals that cannot be returned to the wild, an education center where visitors can learn about conservation, and an eco-lodge (Samboja Lodge) to generate income from guests.

**Insert Figure 1 About Here**

But how does a re-created rainforest sustain the community, meet its needs, and protect the rainforest at the same time? Each family that sold its land not only got money in return but jobs and education. They could work in fire protection, reforestation, farming, construction, or care for the orangutans. In addition, they got a plot of land on which to live.[19] [20] Plots were developed in steps. First roads were built to bring people water and electricity. Then trees were planted for shade and boundary making. In step two, sugar palms and salak palms were planted under the shade trees, while thorny palms provided a fence to protect people and provide a sanctuary for the orangutan. In Step 3, removal of some of the shade trees promoted the flowering and fruiting of the sugar palms and enabled the building of a 6 x 12m wooden house. Families could use the Acacia trees as building materials for their houses and waste wood for cooking and making handicrafts. Each family tending a plot must clear the ground of alang-alang and all undergrowth that is flammable. Then they are encouraged to grow their crops between the trees and sell part of their fruit to the orangutan project. According to Muhammad Trafakhur Rochim, the Indonesian coordinator of human development, the workers have an advantage. "The contract to supply food for the orangutans is worth 125 million Indonesian rupiah (about 14,000) a month for farmers for a total of 150 people," while he estimated that "the average monthly incomes for a worker in the villages is between one and two million rupiah.[21] They also get contracts for selling the sugar water from the palm trees to locally produce ethanol and energy. In 2007 Smits, one of the founders of the Masarang Foundation, opened a palm sugar factory[22] that uses thermal energy to turn the juice tapped daily from sugar palms into sugar or ethanol which then returns electricity to the community. In all, 648 families derive an income that supports 3000 people. Thus, Smits' design not only produced crops for immediate use, but staggered planting enabled other trees to grow and produce fruits, timber, fuel, and permanent income from the sugar water.

To sustain the program, not only did it have to adhere to local cultural values ("everyone is family"), but it had to be supported by the local people to ensure a transparent, fair system to prevent corruption and poaching of the animals and woods.[23] A system of justice evolved in Samboja Lestari where thirty-four groups of 20 families each self monitored to ensure

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[19] Little, J.B. Regrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html

[20] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[21] Thompson, S. Borneo Experiment Shows How Saving the Apes Could Save Ourselves. This Magazine, May 17, 2010, http://this.org/magazine/2010/05/17/apes-saving-humans/

[22] Masarang Palm Sugar Factory, http://www.sugarpalmtree.com/palmsugar-trip-tomohon.html; http://www.masarang.nl/en/about-masarang/

[23] Willie Smits Restores a Rainforest, TED talk, "Willie Smits restores a rainforest". http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;

accountability with the community's standards and protection of the habitat. If a member violates the community agreements, the other members have to decide what is going to happen to him. In North Sulawesi the community has a democratic culture and runs a cooperative so it relies on the local justice system to sustain the community agreements.[24] Thus, by establishing both economic and political legitimacy, Smits was able to create the incentives for long-term ecological and economic restoration.

## RESULTS

By 2008, Balikpapan in East Kalimantan was no longer the poorest district. Smits' videos summarized some the results.[25] There was a return of biodiversity with no more fires or flooding. Today it is home to a lush rain forest with almost 700 butterfly and insect species and 578 plant species. Half million trees belonging to 1,300 species are now growing on 1,000 hectares. Nearly 2,000 homeless and mistreated orangutans have been provided a safe haven and around 700 reintroduced back into the wild. Bird species are up from 5 to 137 which include the rare Harnbill. Reptile species have increased to 30 and primate species to 9. They include the Sun Bears, rescued from deforested areas or confiscated from the illegal pet trade, as well as the endangered Proboscis monkeys, porcupines, pangolins, mouse deer.

In addition, the climate around Samboja Lestari has changed. The temperature has dropped 3-5 degrees Celsius and the air humidity is up by 10%. After three years into the project, the cloud cover increased 11.5% and the rainfall by 25%. Not only did rainwater prevent forest fires, but the reforested land became a source of fresh water. Smit's Foundation, with the help of a grant from the Dutch government, as well as local companies in East Kalimantan, created the infrastructure to deliver clean water. In partnership with the Balikpapan City Water Company, BOS supplies water to approximately 30,00 people (7,000 households) in the neighboring cities and receives a portion of the profits which are returned to sustain the Samboja Lestari rainforest.[26] [27] City inhabitants, aware that their water supply depends on the rainforest, have additional incentives to protect it.

***Design Elements.*** Willie Smits' efforts in tackling wicked problems are the embodiment of the design approach to problem solving. Although he only occasionally uses the term "design"[28] to describe his work in Samboja Lestari and Masarang, the foundation he set up in North Sulawesi,

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[24] Willie Smits Restores a Rainforest, TED talk, "Willie Smits restores a rainforest". http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;

[25] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[25] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[26] Ashoka, Innovators for the Public, Willie Smits, http://www.ashoka.org/fellow/willie-smits

[27] Drinking water is a serious problem in the area. In Balikpapan, a nearby city, population of 550,000, only 50% have tap water. Eighty percent of the land is surrounded by salt water. Artesic wells have been shut down due to salt water intrusion and only deep wells provide potable water.

[28] Willie Smits, The Amazing Power of Sugar Palms, http://www.qi-global.com/10ws

Indonesia in 2001,[29] his activities, intentions, and behaviors as well as the results he and the community have achieved, are very compatible with the design approach.

***Change-Oriented Design.*** Willie Smits launched his change agentry trying to save the life of one orangutan and then expanded his mission to look after others given to him. Needing additional space and a longer-term solution of rescuing, rehabilitating, and releasing orangutans into the wild, he created the Borneo Orangutan Survival Foundation in 1991, the biggest primate conservation NGO worldwide, now employing between 600 and a thousand people.[30] Initially established with the help of thousands of schoolchildren in Balikpapan contributing small amounts of money, it now operates under formal agreement with the Ministry of Forest and has almost a 1,000 orangutans under its care (Thompson, 2010).

To ensure orangutan survival against the onslaught of mechanical logging that was taking over two million hectares a year, Willie Smits then understood he needed to recreate rainforests—the orangutan's natural habitat—from totally denuded land. Reforestation first began in Samboja Lestari and then expanded into Masarang and a number of smaller areas of North Sulawesi, Indonesia where now more than 1 million trees have been planted.[31] Moving counter to traditional views that rainforest can't be recreated once they have been destroyed,[32] Smits invented and introduced new land management techniques that made rainforest revival possible—sustainable farming and remote monitoring of forests through satellite coverage. (See below). And to ensure their long-term viability against logging pressures, Smits developed new job opportunities for thousands of people and engaged them as protectors of the forest to insure its sustainability. (See below). The results of these changes have not only have created rainforests for the orangutans, ensured jobs and a livelihood for the people in the local communities, but, as noted above, they have stopped the flooding and peat fires, and changed the climate by increasing the cloud cover and rainfall and decreasing the temperature.[33]

***Holistic Design.*** Smits sees the world in system terms—"life in harmony"—a phrase he uses in all of his presentations to describe the interconnections of all systems among the animal world, the planet, and humankind. The center of his system for conservation and community renewal in Indonesia is the sugar palm, the deep-rooted feather palm called *Arenga pinnata* which he has studied for years.[34] The sugar palm has unique features from a systems perspective. It can grow in poor soil types, even on steep land eroded by logging and fire that is useless to both man

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[29] Masarang Foundation, http://www.masarang.nl/en/;

[30] Borneo Orangutan survival Foundation (BOSOhttp://learningtogive.org/papers/paper247.html

[31] Masarang Foundation http://www.masarang.nl/en/initiatives/index.jsp?USMID=82

[32] Little, J.B. Regrowing Borneo Tree by Tree, Scientific American, December, 2008, 64 – 71. http://www.nature.com/scientificamerican/journal/v18/n5/full/scientificamericanearth1208-64.html
Thompson, Borneo Experiment Shows How Saving the Apes Could Save Ourselves , This Magazine, May 17, 2010, http://this.org/magazine/2010/05/17/apes-saving-humans/

[33] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=82

[34] Sugar Palm should not be confused with the Oil Palm which is highly destructive of the ecosystem. Although it is a cash crop easily grown in Indonesia, oil palms are not sustainable to harvest. Their operations require clear cutting, uncontrolled burning, and illegal logging that destroy the tropical rain forests leaving orangutans with no food or a place to live. See the Amazing Power of Sugar Palms, http://www.qi-global.com/10ws; Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests

and nature, a condition that afflicts much of the land in Indonesia. Using a process he has developed, a forest with sugar palms can be re-grown within five years, and with it, the ecosystem and diversity of animal life returns. Sugar palms also turns out to be highly productive for the community. Calling it a "sweet solution," (Figure 2) [35] Smits has demonstrated that in only a few years after a tree is planted, a daily amount of juice from it can be tapped by cutting a thin slice off a branch. Mature trees can produce up to 50 litres a day with a sugar concentration of about 11%, without destroying the tree, without removing, on balance, nutrients from the soil, or without cutting off branches and fruit to harvest the energy. With sunlight, CO2, and little water and no fertilizer, sugar palms can produce over 60 different kinds of products ranging from bio fuel (e.g. bio-ethanol) palm sugar, bio plastics, and extremely strong fibres that can be used for roofing, medicine and wood (after the tree's life cycle has ended). Comparisons with other crops have established the superiority of the sugar palm. For example, it provides three times more energy than sugar cane. Thanks to its efficient leaf structure that enables it to capture sunlight, photosynthesis takes place during a longer time period per day and harvest occur twice daily throughout the year.[36] As additional advantages, the sugar palm has a deep root system that provides protection against soil erosion. It also is fire and flood resistant, and because it only grows in a diverse forest, it is able to support and maintain the integrity of a bio-diverse forest.

**Insert Figure 2 About Here**

Smits understands that the vast potential of the sugar palm only can be unlocked when working in a holistic way with production, forest preservation, and community development all operating in tandem. For example, as the core of a waste-free system to produce organic sugar, alcohol, and ethanol (for domestic and foreign use), the sugar palm also provides jobs while producing green and CO2- positive products.[37] Since harvesting the tree sap relies on manual tapping, local farmers have employment. One farmer typically is responsible for about six trees and receives an income that is much higher than regular small farmers. Increased income enables the farmers' families to escape poverty, their children to study, and as their incomes increase, they are less inclined to cut down the rainforest illegally. The locals also do not have to work in polluting industries such as gold and coal mines or in the destructive oil palm plantations. The sugar palm *also provides* food security: the fruit can be harvested and sold as a delicacy; a starch, sago, can be extracted from the stems; and the high-carbohydrate juice can be used to make a palm sugar that is a healthier substitute for white cane sugar. Thus, the Arenga sugar palm serves many purposes but most importantly, it is the anchor in a very sophisticated system that provides energy, jobs, enhanced local food security, and safeguards to the environment.[38]

***Integrative Design*.** In pursuing change Smits proceeds as nature does it—with an integrative design.[39] He began as a rainforest inventor with over 30 of his own inventions such as the gene bank for indigenous trees that he set up as a young forestry engineer. He also has done groundbreaking research into fungi, what he calls "the key to the regeneration of the

[35] Sugar Palm: A Miraculous Tree http://www.masarang.nl/en/initiatives/index.jsp?USMID=90
[36] Sugar Palm: A Miraculous Tree http://www.masarang.nl/en/initiatives/index.jsp?USMID=90
[37] Sugar Palm: A Miraculous Tree http://www.masarang.nl/en/initiatives/index.jsp?USMID=90
[38] Sugar Palm: A Miraculous Tree http://www.masarang.nl/en/initiatives/index.jsp?USMID=90
[39] Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests

tropical rainforest." His studies of the mycorrhizal fungi have improved the uptake of Meranti tree's water and nutrients from the soil, and with the use of this fungus, he has achieved faster growth of young seedlings. His later inventions, on which he has a patent pending, [40] have focused on the ethanol production. Yet Smits insists that creative ideas and reliance on science and technology need to be balanced with the community's needs. Building on his expertise as a forester and microbiologist, and extending it into nature conservancy, community empowerment and economic development, his approach is an interdisciplinary one that refuses either/or thinking.[41] He believes that conservation and development and meeting people's needs do not have to be in conflict. His worldview is founded on the principles of "People, Profit, and Planet."[42] He asserts that solutions to environmental problems must not be addressed in isolation, but rather they must link multiple interests. They must yield money (be economically feasible), be ecologically sustainable, establish clear legal status (e.g. work in a local e.g. legal context), be socially acceptable, and science-based (Figure 3).

**Insert Figure 3 About Here**

Masarang provides a good example of his integrated approach to design.[43] When replanting the forest with approximately 1 million trees, 200 jobs were created in sustainable forestry and sugar-palm and fruit cultivation. Seven formerly dried up springs now provide water. Flooding has stopped in the lower lands. With better water management and improved climate (increase in rain and lower temperatures), rice production has added one extra harvest a year, representing a quarter of million kilos of extra rice. The forest is now home to endangered species and plants and absorbs an estimated 5,000 additional tons of CO2 per year. The animal rescue center at Masarang has given shelter to more than 2,000 animals of 110 different endangered species since it opened. Volunteers and local employees rehabilitate the animals, if possible, before returning them to nature.

***Collaborative Design.*** Smits' projects involve contributions of the many—a large and growing network of government officials, international foundations, businesses, and ordinary citizens online who donate money to his foundations. But most notable in his bottom-up effort is his "design team"—six thousand sugar palm farmers in North Sulawesi through Smits' Masarang Foundation and thousands of others in Samboja Lestari through the Borneo Orangutan Survival Foundation.[44] All projects are carried out with the cooperation and active participation of the local people. Through his messages and actions, Smits underscores his central point—nature preservation is only sustainable if it is rooted in the local community and the locals benefit from it and support it. To achieve these ends, clear legal status of the land is established in order to protect it from outside influence and to ensure it belongs to the foundations that govern them and the people who live and work the land.[45]

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[40] Patentdocs, http://www.faqs.org/patents/inventor/smits-6/
[41] Willie Smits, Replenishing a Rainforest, Momentumand Tides, http://fora.tv/2009/09/08/CARBON_Willie_Smits_on_Replenishing_a_Rainforest
[42] Qi, Global Network of Innovators, People, Profit, Planet Approach, http://www.qi-global.com/10ws1/

[43] Masarang Foundation, http://www.masarang.nl/en/
[44] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=89
[45] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html;

Collaborative culture is reinforced in all Smits' projects.[46] In Northern Sulawesi, for example, cooperatives have been set up where people choose their own coordinators and representatives and have annual shareholders meetings. Smits calls it a "totally democratic system" in which people are fully involved and the decision making is collaborative. In the Minahasa region, the Mapalus project, which stands for "doing together," reinforces another community tradition.[47] Here farmers cultivate the land together as a group and move from one piece of land to the next. Members of the project also coordinate their efforts to determine which crops to grow in order to ensure a diverse range of vegetables and to avoid overproduction of a given crop that would yield lower prices in the market. Based on the knowledge they gain from scientific studies (see below), crops are carefully selected to produce in ecologically optimal way. Some are selected because they positively influence each other's development in terms of nutrients, sunlight, and protection against disease. Others are rotated to avoid deleterious effects e.g. farmers are asked not plant tomatoes after potatoes because both are sensitive to the same fungi. Through these collaborative efforts, the Mapalus project of Masarang has required less fertilizers and pesticides and produced higher agricultural yield. To date, around 10,000 farmers are involved in this project.[48]

***Leader Activated and Orchestrated Design***. Leadership from a design perspective outlines a vision and attracts and engages others in its quest.[49] In 1991, Smits founded the Borneo Orangutan Survival Foundation developing a "land purchasing" initiative called "create a rainforest" where people from all over the world symbolically could "adopt" square meters of rainforest. Donors viewed and followed the progress of "their land" with Google satellite images to compare and contrast the land before and after the reforestation. Since its inception, BOS has grown to be a major foundation with sister organizations in the United States, Netherlands, Australia, Germany, Austria, England, Japan, Canada, Denmark, Switzerland and France.[50] Smits is also is one of the founders and chairman of the Masarang Foundation that was established in 2001 and dedicated to forest restoration and the empowerment of local people. He

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Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[46] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[47] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=81

[48] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=89

[49] Smits' early preparation for collective leadership was an educational one. He completed a master's degree in tropical forestry in the Netherlands after his first visit to Indonesia in 1980. In 1985, Indonesia's forestry ministry invited him to return to address the problem of fungi that was attacking hardwood trees. Continuing his interest and studies, he became a senior advisor to the Indonesian Ministry of Forests and eventually received a doctorate in tropical forestry and soil science from the Agricultural University of Wageningen, Netherlands. From these early beginnings as a forestry engineer and microbiologist, Smit launched his conservation and organizational efforts in the community. He started working at Wanariset, the world's largest orangutan reintroduction project in the tropical rainforest near Balikpapan in Indonesia's East Kalimantan province. He also started the Wanariset forestry research station to study reforestation techniques. In the early '90s, he was team leader of the Tropenbos Kalimantan Project, an international partnership between the Indonesian Ministry of Forestry and the Tropenbos Foundation.[49] Subsequently he became director and eventually chairman of the Gibbon Foundation that focuses on animal conservation in Indonesia, an advisor to the Indonesian Orangutan Survival Program, and chairman of the Board of Orangutan Outreach.[49]

[50] Orangutan Survival Foundation, http://learningtogive.org/papers/paper247.html

also designed and served as director at Schmutzer Primate Center at the Ragun Zoo that opened in 2002. In 2006, he launched TV Dimesi (RV 5 Demensi), a North Sulawesi local television channel that is based in Tomhon. Reputed to be the number one television news source, it is an affiliate of Voice of American, Deutsche Welle, Media Nusantara Citra, and TV Edukasi, and other national television with services to more than 4 million people in more than 8 counties in North Sulawesi and North Maluku Indonesia.[51] And in 2007, he opened a sugar palm factor that uses thermal energy to transform the juice from sugar palms into ethanol which returns cash and power to the community (see below). For these and other achievements, Smits has received numerous awards. He was the first Indonesian with foreign roots to become "Hero for the Development of Indonesia," a prize given to him by the president in 1994,[52] and in 1998, the first non-Indonesian to receive the Satya Lencana Pembanguan Award.[53] He has been singled out by the Rocky Mountain Institute as the world's leading protector of orangutans and their habitat and with Samboja Lestari as possibly "the finest example of ecological and economic restoration in the Tropics."[54] He was elected as a Ashoka Fellow in 2007 which recognizes him as a leading social entrepreneur with innovative solutions to social problems.[55] In 2007, the Masarang project was one of the finalists in the World Challenge and the BBC named Masarang on the the 12 best charities in the world, and in 2009, won the Padma Award granted by the Indonesian Ministry of Energy.[56] In 2010, Smits received Conde Nast's 21st Annual Environmental award[57] and he was knighted in the Netherlands for his conservation work.[58]

***Research-reliant Not Research-constrained Design.*** Trained as researcher with natural proclivities as an inventor, Smits views science and technology as handmaidens to his efforts in reforestation, conservation, land management and sustainable agriculture. But rather than searching for universal scientific principles, his purpose is the design of a unique system for a particular region in Indonesia that is ecologically sound, socially acceptable, and economically viable. To this end he has launched extensive data collection using multiple methods to guarantee transparency, validity, and measurable results. In the region of Masarang, for example, he has built a unique biodiversity database to chart the distribution of animals and plants and uses it as a tool to understand the development of biological diversity in this region.[59] Conducting interviews with farmers, he and his team find out what farmers have grown, what the proceeds and problems are (e.g. crop diseases) in each area. Combining the data he creates an

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[51] TV 5 Dimensi, http://en.wikipedia.org/wiki/TV_5_Dimensi

[52] Masarang Foundation, http://www.masarang.nl/en/about-masarang/willie-smits-en.shtml
[53] Willie Smits, Wikipedia, http://en.wikipedia.org/wiki/Willie_Smits
[54] Willie Smits, Handing Around with the Orangutans, http://www.odemagazine.com/doc/60/willie-smits-hanging-around-with-orangutans/
[55] Ashoka, http://www.ashoka.org/fellow/willie-smits
[56] Masarang Foundation, http://www.masarang.nl/en/about-masarang/
[57] Willie's War: The 21st Annual Environmental Award, http://www.concierge.com/cntraveler/articles/503118?all=yes
[58] Willie Smits, Wikipedia, http://en.wikipedia.org/wiki/Willie_Smits
[59] Willie Smits Shares Methodology for Sustainable Forests, fhttp://www.esri.com/news/arcnews/winter0910articles/willie-smits.html;
Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests;

image of which crops do best at which place at what time. Students affiliated with local schools and universities also provide a network of measurements e.g. using small herbs as soil quality index. They also examine the soil for its composition and possible pollution and map microclimates by location. All the data are stored in GIS (geographic information system) database.[60] In collaboration with the European Space Agency, Smits then combines the GIS data with satellite imagery and displays the data in three dimensional satellite maps. With land divided into strips, the maps reveal the topographical images of soil types, climate, crops and their conditions. Using GIS and satellite images, the cooperative in Masarang can direct their activities and decide where and when to extract the sugar palm's liquid. They also can identify the best roads for oxcart and automobile transport, the village processing points, and the placement of the product for gravitational transmission to the coast for export. It also gives them the ability to predict crop yields and determine the amount of labor needed for planting and cultivation. Smits also uses GIS and satellite imagery to monitor every single tree from space. Ten percent of all trees are re-measured once a year[61] and the ground carbon is monitored in detail. Thus, using these data, the community builds an understanding of how an ecosystem is formed and evolves, and most importantly, how a vanished ecosystem can be rebuilt.

***Embodied Design.*** As the above examples illustrate, Smits follows the principle of embodied design. His intense observations and insistence on learning from nature[62] to find practical solutions to pressing problems in his local community mark him as someone who "*learns in place.*" His crucible and test bed are in the communities and deforested areas of Borneo and North Sulawesi that offer him opportunities to experiment, develop prototypes, and generate immediate feedback on his regeneration and renewal efforts. Thus, Smits "learns by doing." His prototypes e.g. the use of bamboo to filter waterways, or his pattern for planting sugar palms, are treated as experiments. When results are positive, the idea is applied elsewhere. One prototype, the sugar palm village hub, is a green factory in a box that attempts to imitate nature as an integrated, sustainable production system. Illustrated in Figure 4, its purpose is to enable local rural communities in remote Indonesian regions to process sugar palm juice in small factories and in so doing provide local employment, the generation of their own local energy supply, and preservation of their forests.[63]

(Insert Figure 4 About Here)

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[60] Willie Smits Shares Methodology for Sustainable Forests, fhttp://www.esri.com/news/arcnews/winter0910articles/willie-smits.html; Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests;

[61] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits Replenishes a Rainforest, http://www.momentumconference.org/speaker-presentation/speaker/willie-smits/presentation/confirmed-2009-speaker-26/index.html

[62] Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests

[63] The Amazing Power of Sugar Palms, http://www.qi-g; Willie Smits - Conservation" http://tedxtalks.ted.com/video/TEDxPearlRiver-Willie-Smits-Con;Willie Smits: Replenishing a Rainforest, http://fora.tv/2009/09/08/CARBON_Willie_Smits_on_Replenishing_a_Rainforest;

Other prototypes come from Smits' research studies in biodiversity, carbon, climate, and costs. He calls them his "recipes."[64] He starts with things he can control e.g. the land to determine what trees and vegetables grow where and with what nutrients. He then drops these ingredients on a map to calculate the fertilizer and labor and skills needed and the costs associated with different soil types. Outputs are then measured to determine the recipe's results. If successful, they are used to set production targets, for example he learned that only a thousand trees could be planted in a day to keep the jobs stable. When combining all the recipes from different plots of land, he then has a business plan, a work plan that enables him to optimize production for the available labor and land.

***Action Oriented Design.*** An action orientation requires the implementation of an "experience blueprint" to test new ideas for their resonance and acceptance by others, especially those offered by competitors. It also necessitates attention to process—lots of stories, advocacy, and a constant stream of information to remind people in a meaningful way what the problems are and how to address them. Smits excels at both. In 2007, using fuel leftovers from the state energy company Pertamina's geothermal gas production, he opened a sugar palm factory in Masarang. Farmers bring nira, the white sap they tap from the sugar palm trees, for processing in the factory, similar to the one shown in Figure 4. It uses thermal energy to turn the juice tapped from sugar palms into sugar and ethanol as well as soy-like sauce, vinegar, even rum and beer. Run by the Masarang Foundation, it is a "zero waste" facility where even furniture is made from waste wood and every stem and branch of the sugar palm is utilized. Not only does it provide income for 648 families, but it saves 200,000 trees per year from being cut down and used as fire wood.[65] Smits is convinced this "environmentally friendly factory" could be a model for other Indonesian regions. Eight other provinces have an abundance of sugar palms, but according to Smits, they have not done much to capitalize on them. He contends that if Indonesia made the most of its sugar palms, its need for imported sugar would disappear in two years.[66]

Reliance on sugar palms has other benefits as well. In Tomohon, the area in which he lives, a farmer whose fields have three sugar palms can earn at least Rp 70,000 (US$6) a day working less than two hours tapping the trees.[67] Even more significant, sugar palms are a new source of energy that can produce more energy per hectare per year than other bio fuel crops yet without the negative impacts of other well-known bio-fuels.[68] To champion these ideas, he founded and is chief science officer of Tapergy, an organization that advocates sugar palms as a viable alternative energy source.

As part of his action orientation, Smits spends an increasing amount of activity disseminating information, doing outreach and education, and raising public awareness. His talks at QiGlobal[69]

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[64] Willie Smits Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html; Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests;

[65] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=89

[66] Willie Smits, Restores a Rainforest , "Willie Smits restores a rainforest"; Willie Smits Video, The Amazing Power of Sugar Palms, http://www.qi-global.com/10ws;

[67] Amazing Power of Sugar Palms, http://www.qi-global.com/10ws;

[68] The Amazing Power of Sugar Palms, http://www.qi-global.com/10ws; Sugar Ethanol, http://www.sugarpalmethanol.com/2010/06/tapergy.html;

[69] The Amazing Power of Sugar Palms, http://www.qi-global.com/WILLIE-SMITS

and TED[70] have brought him and his ideas worldwide recognition. A movie is in production to energize 1,000,000 young people to challenge deforestation.[71] But what is really capturing attention is his design challenge to alert the world to the dangers and costs of palm oil which is used in everything from beauty products to biofuels. According to the Worldwatch Institute,[72] Indonesia is the planet's largest supplier of palm oil. Its plantations annually subsume some 80,000 acres of forest per year and with it disappears the vast part of the biodiversity of Southeast Asia. Only 300 million acres of tropical Indonesian forests remain.

Smits believes the key to stopping this destruction is the sugar palm. Smits details its advantages over Brazil's sugarcane and its success.[73] "Palm sugar produces three times more sugar than sugarcane;" it has a "lower glycemic index than regular sugar" and does not have the deleterious impact on human health; it does not deplete the soil and then fail to thrive; it only grows in mixed, secondary forests and allows other species of plants and vegetables to co-exist and flourish; after two or three years, it requires no pesticides or fertilizers unlike the oil palm; it can grow on a mountain, be harvested daily, and provide 20 times more jobs for tappers and farmers compared to oil palm or sugarcane. According to Smits, "by 2030, we could replace all of the world's oil with ethanol from sugar palm."[74] It is the only form of renewable energy that can be produced on a large scale and is ready to go today.

Moving innovative ideas to scale is what Ashoka[75] is all about and one of the major reasons Smits was elected to be an Ashoka Fellow in 2007.[76] To be inducted, fellows undergo and meet a rigorous search and selection process. As "change makers for the world" and "innovators for the public," they are leading social entrepreneurs whose solutions to major social problems have potential to change patterns in their countries and beyond. Smits and others believe that his innovative sugar palm solutions to stop deforestation, protect endangered species, and sustain biodiversity in Indonesia may well be solutions for other areas of the globe. The orange regions in the Figure 5 map identify those parts of the world.[77] Sugar palms can grow in areas that are greater than 4 degrees Celsius, with rainfall greater than 750mm per year, at an elevation less than 2,000 metres, with an infrastructure to bring out the sugar sap (50 kilometers from waterways or roads), with labor available, and income levels to make it economical for one household to produce five liters of ethanol per day in addition to other output.[78]

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[70] Willie Smits, Restores a Rainforest, http://www.ted.com/talks/willie_smits_restores_a_rainforest.html

[71] Masarang Foundation, http://www.masarang.nl/en/media-gallery/index.jsp?USMID=103

[72] Worldwatch Institute, http://www.worldwatch.org/node/6059

[73] Willie's War: The 21st Annual Environmental Award, http://www.concierge.com/cntraveler/articles/503118?pageNumber=2

[74] Willie's War: The 21st Annual Environmental Award, http://www.concierge.com/cntraveler/articles/503118?pageNumber=2

[75] Ashoka Fellows, http://www.ashoka.org/fellows; Willie Smits, Asoka Interview, http://www.youtube.com/watch?v=Gk9NUwxQc80

[76] Willie Smits Interview for Asoka, http://www.youtube.com/watch?v=Gk9NUwxQc80;

[77] Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests; Sugar palm Ethanol, http://www.sugarpalmethanol.com/2010_06_01_archive.html

[78] Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests; Sugar palm Ethanol, http://www.sugarpalmethanol.com/2010_06_01_archive.html

**Insert Figure 5 About Here**

**Summary.** Smits only occasionally uses the term "design" to describe his work in Samboja Lestari and Masarang. But the work he does, the results he achieves, and the process he employs all are a very good fit with the design approach to problem solving. His bottom-up approach to change successfully demonstrates how to balance what is technologically feasible, economically viable, and humanly desirable all the while adhering to the eight design principles—change oriented, holistic, integrative, collaborative, leader activated and orchestrated, research reliant but not research constrained, embodied learning, and action oriented.

## IMPLICATIONS OF TACKLING WICKED PROBLEMS BY DESIGN

Can Smits' design approach to tackling our wicked problems be utilized elsewhere? A growing legion of social entrepreneurs is active worldwide, but we have yet to identify what principles and models of change agentry guide their activism. Systematic studies of their work and the models of change that guide their problem solving might give us greater assurance in teaching design principles to others, assuming their results are similar to the Smits case. At this juncture, what we can say with assurance is that Willie Smits offers an excellent example of how to tackle some very wicked problems in Borneo. More studies are needed before we can say with any degree of confidence that wicked problems are no longer as difficult as we thought they were.

In the meantime, we have learned some very valuable lessons from the Smits case that might inform other design projects. Four are particularly noteworthy. First, begin design projects from the bottom-up and "think with your hands." Design teaches us that context matters. Place is important and what works in one place may not work in another given its unique cultural heritage and physical characteristics. Only when prototypes are deemed successful in multiple local settings, only when we have identified the conditions for their success should we attempt their replication elsewhere. Smits' systematic build-out of the sugar palm experiments in Borneo and North Sulawesi may hold promise for other areas of the world, but he understands their launch would require the same careful observation, data gathering, feedback, and adaptation to local conditions. Thus, design advocates would not choose to work in policy arenas and make policy recommendations until and unless they are ready—ready with data, ready with tested ideas and prototypes, ready with results that have demonstrable economic and social benefits. At the same time their bottom-up rather than top-down preference should not be construed as a lack of skill or interest. In Smits' case for example, there is every indication that he has crafted an extensive network of powerholders in Indonesia and around the world. Rather, his bottom-up push for change is an innate desire to retain a "feeling for the organism." It energizes his work and keeps him emotionally connected to the people he serves and the world he is attempting to save.

A second important lesson is that starting small and thinking with our hands from the bottom up is not to be confounded with the taming approach to wicked problems. Taming and bottom-up

change have been confounded and it is important to distinguish between them. To tame a problem is to limit its complexity by removing those factors that create divisions and conflict in the problem solving space. Examples of taming include moving the problem off the decision agenda, minimizing the number of people who participate in problem solving, excluding data and ideas that don't support our own, or simply redefining the wicked problem to something easier to solve instead of one that is messy and conflict-ridden. In contrast, the design approach tackles wicked problems in all of their complexity as a whole system, but at different *scales* (Dust & Prokopoff, 2009). Rather than address deforestation on a grand scale worldwide, Smits began with what he knew about the land and the people in a small area of Borneo. Once he learned how the complex system of deforestation and its component parts were interrelated on a small scale (e.g. fires, floods, oil palms, pollution, soil degradation, species extinction), he then had insights about how the larger international system (e.g. international trade, government policy, and unbridled capitalism) fueled deforestation at the local level. All problem solvers face similar challenges. How should I define the system and its component parts? Where are the boundaries to the wicked problem territory? What level or scale makes sense to attack the problem given the challenges I am confronting and the resources I have? Crafting answers to these questions makes design more of an art than a science but at least it enables the designer to begin the work. The key point to remember is that selecting a particular vantage point or scale from which to explore wicked problems as a system is not the same thing as attempting to tame a problem for political expediency, personal gain, or simply ease of management. The idea is to choose a scale that offers a way into wicked problem territory and enables exploration of wicked problems in all their attendant complexity. As Smits has demonstrated, the designer always has the option of moving into different levels or scales as learning and resources permit. The important point is to begin somewhere—best to do that at a level that is a good fit with the problem territory and the designer's knowledge, skills, and competencies.

Thirdly, fighting wicked problems like crime and corruption *does not have to take a direct approach*. For example, the decrease of crime and corruption in this region of Indonesia was not the original goal or the intention of Willie Smits and his collaborators. It was an unintended but fortunate consequence of a *systemic design* to reforesting areas of Borneo and protecting its endangered species. Only when tracking some of the downstream results did the second-order effects become apparent. Crime reduction (by 50%) followed when local people had jobs tending nurseries, planting trees and agricultural crops, regenerating denuded land, patrolling against forest fires, and maintaining animal reserves. They also had small plots of land on which to build a house and to grow cash crops such as sugar palms along with training and education for themselves and their children all of which gave them less incentive to resort to illegal logging and poaching of endangered species. When Smits set up Foundations to secure land titles, he also prevented local officials and politicians from wresting control of the land from the local tribes and selling titles to international interests. The system of community self governance he established enabled local people to share in the benefits and profits while the system of justice that evolved ensured that long-term community interests were protected. In Samboja Lestari, for example, thirty-four groups of 20 families each self monitored to ensure accountability with the community's standards and protection of the habitat. If a member violated the community agreements, the other members decided what to do with those who had violated community norms. Smits' design interventions also had second-order effects that checked corruption at the regional and international levels. Thanks to the reforestation, increased rainfall in Samboja

Lestari enabled the Foundation to sell water to the surrounding communities. In Balikpapan, a nearby city, population of 550,000, only 50% have tap water. Eighty percent of the land is surrounded by salt water. Artesic wells have been shut down due to salt water intrusion and only deep wells provide potable water. So in partnership with the Balikpapan City Water Company, the Foundation Smits set up supplies water to approximately 30,00 people (7,000 households) in the neighboring cities and a portion of the profits which are returned to sustain the Samboja Lestari rainforest. These communities now have incentives to protect the forest which supplies their water, limiting further encroachment on the land. Switching from oil palms to sugar palms provides a "sweet solution" that empowers local farmers and disempowered international timber interests and the locals who invite them in. His introduction of the sugar palm undercuts the market for palm oil by substituting a more viable product that is less susceptible to corruption since it can't be grown in large plantations. Beyond its many benefits, it only grows in mixed, secondary forests where other species of plants and vegetables can co-exist and flourish. Manual tapping of sugar palms also minimizes destruction to the environment, provides more jobs for local farmers compared to oil palms, and offer a more efficient energy supply. This *indirect approach* to countering corruption and crime is a vivid contrast to current efforts in Indonesia that rely on top-down, government-initiated, internationally-funded interventions that primarily focus on infrastructure development e.g. establishment of the Corruption Eradication Commission directly under the President's Office, issuance of a new law and regulations with the aim of strengthening domestic legislation and the legal framework on anti-corruption,[79] [80] [81] the training of police and forest officials, the provision of equipment etc.[82] This is not to say that these efforts are unimportant. But rather than attempting to check corruption after the fact by bring high-profile perpetrators to jail and recovering stolen assets,[83] Smits' example in Borneo demonstrates that it might be advisable to create systems that that makes corruption less likely to flourish in the first place.

And finally, if building consensus on a problem is the crux of the issue in defining wicked problems of whatever type, it is best to bring in others from the start rather than deal with their challenges and opposition downstream. Collaboration is essential in wicked problem territory to build a culture of design. Rather than "creating for people," design has become "creating with people" with the ultimate ideal of people "creating by themselves." The idea of "Everyman the Designer" is a compelling one says Tim Brown (2009, p. 59). But developing this mindset will take time, so designers need patience. Solutions in wicked problem territory are not short-term but require sustained effort over time. As Smits has demonstrated in his thirty years in Indonesia, wicked problems can be tackled—not easily, not quickly. Instead of being overwhelmed by

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[79] United Nations Office on Drugs and Crime. "Message from the Government of Indonesia." *Corruption, Environment, and the United Nations Convention*, February 2012, p. iv.

[80] Santoso,T. "Indonesia's National Strategy to Combat Illegal Logging and Corruption." United Nations Office on Drugs and Crime, *Corruption, Environment, and the United Nations Convention*, February 2012. pp. 25-29.

[81] Fariz, D. "Corruption in Forest Crimes." United Nations Office on Drugs and Crime, *Corruption, Environment, and the United Nations Convention*, February 2012, pp. 30-33.

[82] United Nation Office on Drugs and Crime, Indonesia Newsletter #24, February 2012.

[83] Schutte, S. A. "Against the Odds: Anti-Corruption Reform in Indonesia." Public Administration and Development, 2012, 32:38-48.

complexity and immobilized by a stunned complacency, Smits's bottom-up approach offers us a powerful alternative to addressing some of the most challenging problems in Indonesia. His remarkable ability and progress have left us with one of the most important lessons of all—there might actually be some way out of wicked problem territory.

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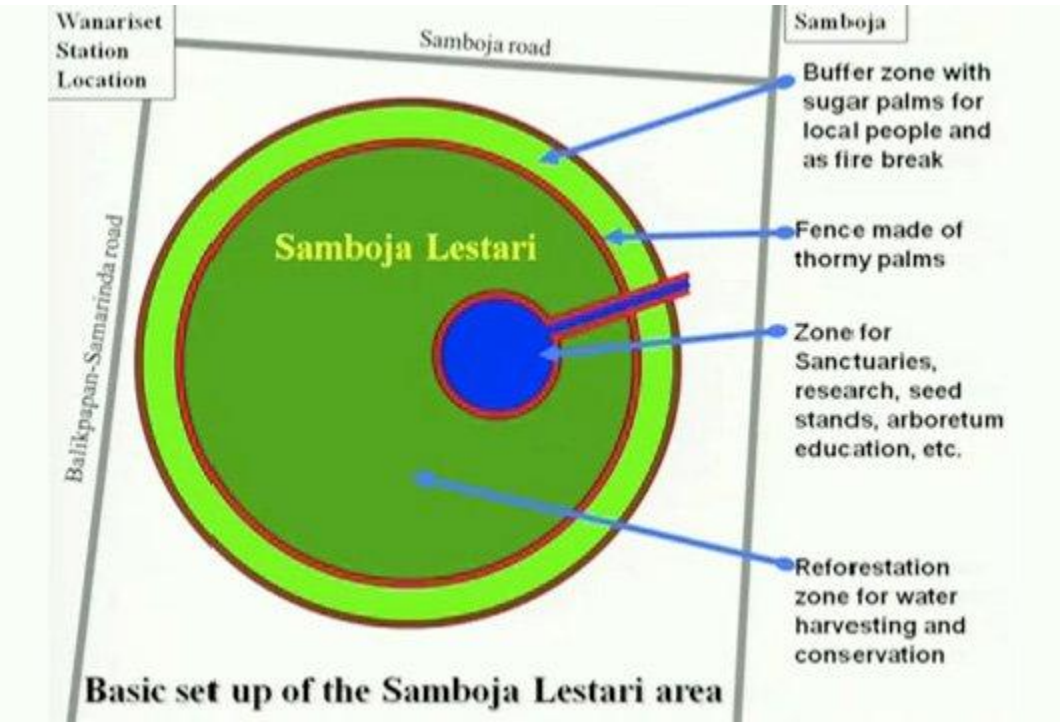


**Figure 1**
**Samboja Lestari Schematic**[84]

[84] Orangutan Outreach, http://www.mnn.com/sites/default/files/user-39/samboja-lastari-red-apes.jpg


**Figure 2**
**Life in Harmony**[85]

[85] Masarang Foundation, http://www.masarang.nl/en/about-masarang/

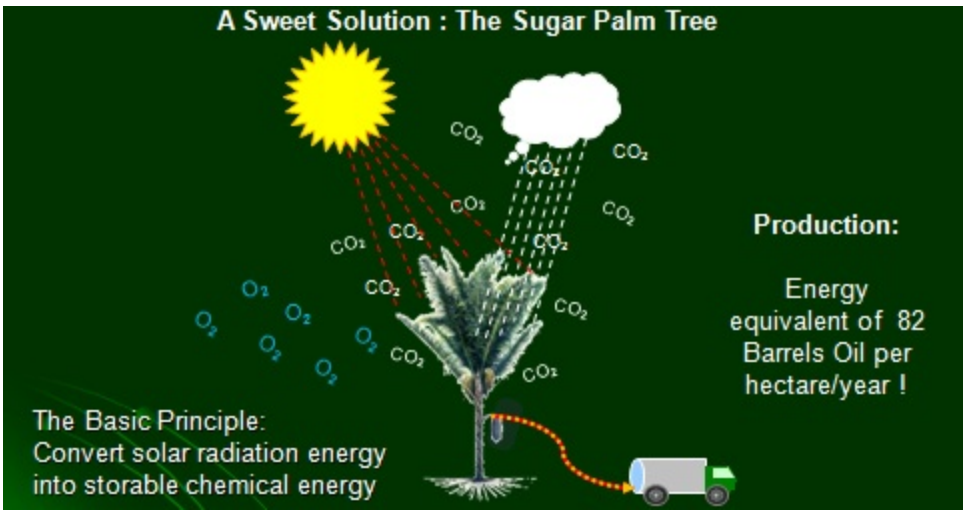


**Figure 3**
**The Sweet Solution of the Sugar Palm Tree**[86]

[86] Masarang Foundation, http://www.masarang.nl/en/initiatives/index.jsp?USMID=90

**Figure 4**
**Factory in a Box**[87]

[87] Orangutan Outreach, http://www.orangutanoutreachnederland.nl/wp-content/uploads/Village_Hub.jpg

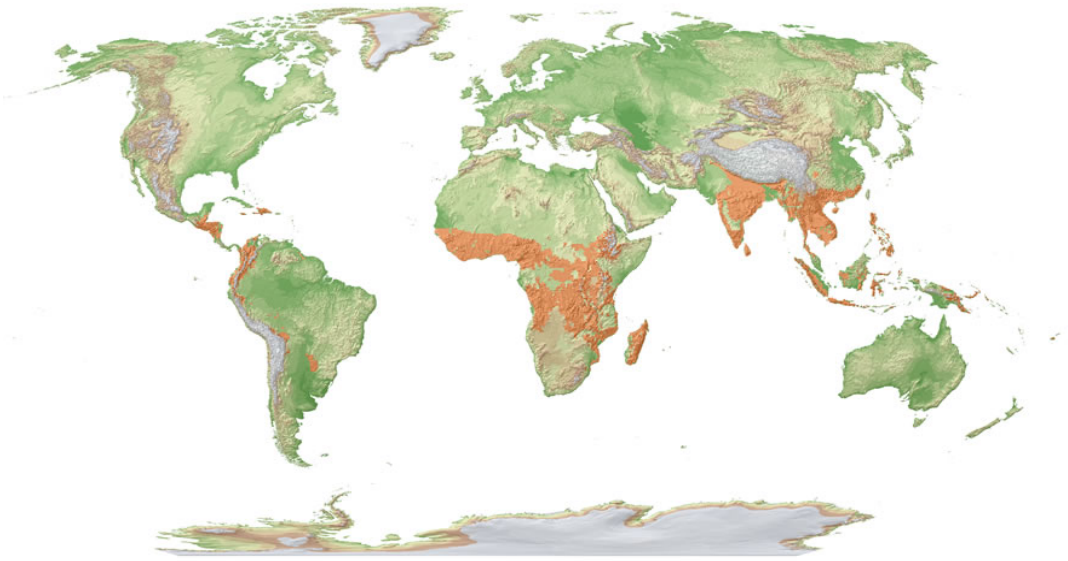

**Figure 5**
**Areas Suited to Sugar Palm Growth**[88]

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http://2.bp.blogspot.com/_QfNJGAl2TxU/TDrKQ44CBsI/AAAAAAAAEpE/OVRNhbJGTw8/s1600/arenga+suited+sectors.jpg; See also Willie Smits, Saving Rainforest http://poptech.org/popcasts/willie_smits_saving_rainforests;