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The Sustainable and Resilient Community: A new paradigm for community development

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Abstract

Sustainable development is a conservation, mitigation and restoration paradigm, and has been the dominant approach to community development since at least 1987 when it was introduced by the UN's World Commission for Economic Development. Resilience is an innovation and adaptation paradigm that has gained popularity as an alternative approach to community planning and has the potential to address challenges which sustainability has not yet successfully managed, such as global warming. A study of rural tourism communities in Taiwan found that all communities had comparable levels of sustainable development, reflecting policies and programs that largely emanate from central government ministries. However, those that had recently experienced a major natural disaster demonstrated much stronger indicators of resilience. Tourism, as an entrepreneurial economic activity, was also found to be closely associated with resilience thinking. Based on these findings, it is apparent that sustainable development and resilience planning are both necessary to prepare communities for the challenges they face in today's world. Because many governments already support sustainability to a significant degree, a stronger turn toward resilience is recommended in central and national government policies and programs.

Keywords: Sustainability, resilience, community development, tourism development, rural development, resilience planning, Taiwan

The "Holy Grail"

Almost two decades ago, Graham Tobin (1999) referred to the integration of community sustainability and community resilience as the "holy grail" for natural hazards planning. In his conceptualization, sustainability was equated to a "mitigation" approach that sought to prevent natural disasters by reducing exposure, risk and vulnerability across the community. Resilience was associated with a "recovery" scenario that not only brought the community back to a state of normalcy but did so in an equitable manner with both short and long term policies that addressed the root causes of the disaster experience. He suggested that natural hazard/disaster planning could only be effective if sustainability and resilience were consistent and integrated, and equitably applied as part of an ongoing planning process that accounted for the changing social dynamics (geography, demography and social psychology) of a place. More recently, Weichselgartner and Kelman (2014) made a similar argument, suggesting that we need to recognize the limitations of sustainability and resilience, starting with the vague definitions that surround each concept.

Our study examined sustainability and resilience in rural tourism communities in Taiwan and resulted in conclusions that were very much in line with those of Tobin (1999) and Weichselgartner and Kelman (2014). Disasters, however, were not the primary focus of our research. Instead, we looked at how communities responded to the full range of changes impacting rural societies today, through the lenses of sustainability and resilience. Evidently, three of the eight communities that we studied had experienced major natural disasters in recent memory. This is due to Taiwan's precarious geography on the Pacific Ring of Fire and directly within the Pacific typhoon path. This turned out to be a key factor in our research findings. We also differed from Tobin by adopting broader definitions of sustainability and resilience that extend beyond the natural hazards disaster context, which was his focus. As such, our conclusions also spread beyond recommendations for communities under threat from natural disasters. In addition, we argue that sustainability and resilience should be the development model for all communities for both short term and long term success in today's world.

An essential element in understanding Tobin's research findings, along with those of our own research and other similar studies, is how sustainability and resilience are defined. Based on the definitions that are adopted, the relationship between these two major concepts in contemporary community development can then be assessed, along with their application to real world contexts.

Definitions of Resilience and Sustainability

Numerous authors have attempted to define the relationship between sustainability and resilience. The result is that almost every possible configuration between the two concepts has been proposed (Table 1). Some view resilience being the same as sustainability, but with a systems science perspective (Adger, 2003; Holling & Walker, 2003). Such a view seems common among sustainability enthusiasts in the general public, as well. Others view resilience as being a subset of the broader concept of sustainability, either by providing indicators of sustainability (Walker & Salt 2006; Schianetz & Kavanagh, 2008; Magis, 2010), or as one way of implementing sustainability policies (Farrell & Twining-Ward, 2005; Anderies, et al., 2013). An opposite position to this places sustainability within the broader context of resilience (Levin, et al., 1998; Peirce, Budd & Lovrich, 2011; Strunz, 2012; Anderies, Folke, Walker, & Ostrom 2013). This approach views strong resilience as a prerequisite for a system before a normative (ethical) sustainability approach can be successful.

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<< Table 1 About Here - Possible relationships between sustainability and resilience. >>

Many of the definitions reviewed so far hint at how and why authors place the two concepts in opposition to one another, with sustainability being a mitigation and conservation policy and resilience being an adaptation and innovation approach (Tobin, 1999; Prasad, Ranghieri, Shah, Trohanis, Kessler & Sinha, 2009; Jeuch & Michelson, 2011; Pearce, Budd & Lovrich, 2011; Davoudi, 2012; McLellan, Zhang, Farzaneh, Utama & Ishihara, 2012; Jepson, 2016; Lew, 2014; Weichselgartner & Kelman, 2014; Lew, Ng, Ni & Wu, 2016). Other hold the same view, but are open to the possibility of overlap between the two (Brand & Jax, 2007; Derissen, Quaas & Baumgärtner, 2011). (Note that some authors seem to have expressed different opinions on these definitions over time, or perhaps in different contexts.)

With the exception of some of the definitions that see little or no distinction between sustainability and resilience, most authors are of the opinion that considerable differences exist. The idea that they are the same comes from the degree to which sustainability and resilience share some common goals and research perspectives when seen from a general point of view. One way to think of this broader view is to consider each concept as a metaphor (Carpenter et al., 2001; Strunz, 2012). As a metaphor, both sustainability and resilience can similarly apply to any action that sustains the current system and the current status quo indefinitely. System survival is a shared goal clearly applies to both concepts (Table 2) (Lew et al., 2016). Both approaches also hold the assumption that human societies and natural environments comprise a single ecosystem that has the potential to be in harmony through appropriate policy measures.

<< Table 2 About Here - Similarities and Differences in the Assumptions and Goals of Sustainability and Resilience. >>

Our research into rural tourism communities in Taiwan began with the assumption that sustainability and resilience were two distinctly different approaches to community development. As the research developed, we shifted that view to one where they were still very different from one another, but with some degree of overlap. We view the overlap lying in areas where policy goals and actions are aligned with similarities defined in Table 2. This can happen when, for instance, we assessed the macro level condition of the economies in our eight rural communities in Taiwan. Whether the economy was strong or weak has both sustainability and resilience implications, which cannot be clearly separated at that particular level of generalization.

The two concepts primarily differ in their assumptions about the normal state and in the goals that result from those assumptions. Sustainability assumes that there is an ideal world which is moral and ethical in its relationships among humans and between humans and nature. This normative goal includes both intergenerational equity (for future generations) and intra-generational equity (which was defined as between rich and poor countries in the original *Brundtland Report*, WCED 1987). Resilience, by most definitions (Brand & Jax, 2007) does not have an equity component. Instead, some of its earliest

influences come out of chaos theory (Faulkner & Russell, 1997; McKercher, 1999) and disaster management (Schwab, 1998). In one of the earliest definitions, Holling (1973: 14) defined the resilience of ecological systems, another major origin of the concept, as the descriptive and quantitative "measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations and state variables." However, it should be noted that critics of resilience contend that the assumption of resilience as being descriptive and non-normative actually hides a neoliberal agenda that is opposed to the equity goals of sustainability (MacKinnon & Derickson 2012; Weichselgartner & Kelman, 2014; Evans & Reid 2015).

Creating a stable and equitable society (sustainability), and creating an adaptable and innovative society that can bounce back from disturbances and change (resilience) are the most fundamental differences between the goals of sustainability and resilience. While these can be compatible, they can also be at odds with one another, especially when considering non-metaphorical scientific and policy definitions of sustainability and resilience. This has to do with the range of definitions that have been applied to these two important concepts over the years, which extend from the simple to the complex (Table 3). In its simplest definition, sustainability means to maintain the status quo indefinitely, which has a high degree of overlap with engineering resilience approaches. This is often what is meant when tourism destination marketing organizations, and similar tourism boosters, talk about the sustainability of the tourism economy (Butler, 1999). The next level of understanding of sustainability is a focus on the efficient use of carbon resources to reduce greenhouse gas emissions from an activity or a community. This has been the primary focus of most green certification programs that are common in the tourism sector. Some of these programs are now attempting to measure broader social impacts, which moves them into a more advanced definition of sustainability.

<< Table 3 About Here - The range of complexity in definitions of sustainability and resilience, from simple to comprehensive. >>

The intermediate definition of sustainability in Table 3 is the one that most consider when they hear the word 'sustainability', which is to take actions that protect the natural environment (Peirce, Budd & Lovrich 2011). This was the primary focus of the *Brundtland Report* when it introduced the concept of sustainable development in 1987, although the report also had broader social goals (WCED, 1987). In general, only more knowledgeable individuals in the general population, including academics and other experts, are aware that cultural resources are also a major part of the concept of sustainability, which is the more advanced definition that the *Brundtland Report* was moving to address.

The comprehensive definition of sustainability is the least understood, and probably most perplexing to many, due to its complexity and all-inclusiveness. The United Nations Sustainable Development Goals for 2030 (UN, 2015) is an example of the comprehensive definition of sustainability. It includes 17 highly diverse objectives, including ending all poverty and hunger on the planet, protecting all life under water and on land, and eliminating gender and other social inequalities. Each of the 17 has more specific and quantifiable goals for the world to reach in 2030. Resilience is mentioned in several goals, but is specifically taken up in Goal 13 on climate change and it impacts, which mentions mitigation

(sustainability; preventing climate change), but tends to focus more on adaptation (general resilience), and impact reduction and impact recovery (engineering resilience).

In terms of the different ways that people use the term resilience in a community context, the simplest is to mean toughness or persistence in some type of difficult situation, which can be viewed as very similar, if not identical to the simplest definition of sustainability (Table 3). People who have not been exposed to resilience theory and resilience thinking are most likely to use this definition, which is almost always considered a good characteristic for a community to have. A more moderate definition is the ability of a community to bounce back to a state of normalcy following a crisis or disaster. Crisis and disaster management is actually the most common type of published academic research in the area of resilience in general (Meerow & Newell, 2015). Although some of that research falls under the engineering resilience approach that is most associated with disaster management, more of it focusses on the longer term social recovery from the disaster, which is characteristic of the intermediate definition of resilience in Table 3. This also includes resilience to non-disaster change events, such as economic and cultural globalization, which aligns with the much sought after goal of measuring the overall general resilience of a community.

The advanced definition of resilience comprises the bulk of resilience theory literature that applies systems science modeling to understanding the social-ecological resilience of a place (system). Much of this comes out of the ecological sciences and generally tend to favor applications to natural ecosystems (Carpenter et al., 2001; Meerow & Newell, 2015), although social and economic systems have also been modeled (Adger, 1997; Baggio & Salnaghi, 2011; Biggs, 2011; Ranjan, 2012). Strunz (2012) suggests that, due to the conceptual vagueness of resilience (which also applied to sustainability), it is better to think of all of the definitions of resilience as "resilience thinking", and limit the use of "resilience theory" to the narrow use of models to describe characteristics of a system (the advanced definition in Table 3). Strunz sees the vagueness in resilience thinking as allowing greater creativity, enabling interdisciplinary and transdisciplinary (outside of academia) communication, and offering more of a focus on problem solving instead of solving quantitative models (which is the focus of resilience theory). These characteristics have also been true for the concept of sustainability (Hunter 1997; Fennell, 2015).

Coming out of systems science, however, resilience also lends itself to more precise scientific and quantitative modeling to identify thresholds and regime shifts that signify the transformation of a system from one state to another (Carpenter et al., 2001; Fiksel, 2006; Strunz, 2012). This tends to be easier for environmental systems with minimal human impacts, although modeling similar economic shifts has also been attempted (Weichselgartner & Kelman, 2014). However, such modeling can also be metaphorical, such as describing how the combined impacts of the Asian Economic Crisis of 1997-98 and the subsequent fall of President Suharto impacted international tourism to Indonesia in a manner that is reflected in the adaptive cycle model (Cochrane, 2010).

The comprehensive approach to resilience is the most complex, in part because evolutionary resilience is one of the newest concepts in resilience thinking (Simmie & Martin, 2010). The idea of constant change was suggested in the foremost definitions of resilience by Holling (1973), but was never advanced, taking a back seat to models that assumed various forms of stability and equilibria that are separated by threshold events. Ecological resilience rejects these concepts and attempts to build an understanding of a world that is in constant flux, if not actual chaos (Davoudi, 2012). This is, however, a

difficult concept to fully comprehend from a rational point of view and is still open to exploration and interpretation.

For our research on resilience and sustainability in rural Taiwan, we adopted the advanced definition of sustainability: that is the conservation or restoration of human and natural resources to a desired (normative) level or condition as a way of mitigating (preventing) undesirable change. For resilience, we adopted the intermediate definitions of the capacity of a community for innovation and adaptation to change, including both disaster events and slow to moderate environmental, social and economic change. These definitions are in line with Tobin (1999) and are supported by a numbers of other researchers, as noted above. This approach provides a clear conceptual foundation for comparing and operationalizing sustainability and resilience. It embraces the ethical and normative nature of sustainability, although it places that in a narrower context than the UN's 2030 Sustainable Development Goals. Our definition of resilience is metaphorical, but can be quantified to a degree, while also offering considerable qualitative research possibilities. The definitions we adopted of sustainability and resilience were well suited to clearly defining each concept and categorizing responses from our informants.

Rural Taiwan Tourism Communities

To empirically address the relationship between sustainability and resilience, we examined community development experience in eight rural villages in Taiwan, with populations ranging from 500 to 1000 residents. All of the villages had some form of tourism-related activities, although they ranged from the very small and nascent, to being major rural destinations. The villages were distributed across a range of geographic settings, including two each in high mountains (Alishan area), agricultural basins (western Taiwan), coastal wetlands (northeast and southwest Taiwan), and small islands (Pescadores/Penghu). Three of the villages had experienced one or both of the most significant natural disasters to ever hit Taiwan. These were the 921 Earthquake (September 21, 1999), which killed over 2,400 people in central Taiwan, and Typhoon Morakot in 2009, which brought record rainfalls, flooding and landslides, resulting in 461 deaths. The other five had not experienced major disasters within the memory of the people interviewed.

The data are based on 22 in-depth interviews with community informants in these village, ranging from 1.5 to 2.5 hours in length. The leaders included: current and past elected village association leaders; non-governmental, non-profit, and social enterprise leaders; consultants working in the communities; and local entrepreneurs, farmers, tour guides and nature interpreters. Often one individual held more than one of these roles in the community. Our questionnaire contained specific sets of questions on local community budget expenditures, local knowledge, and community well-being. This level of community organization in Taiwan usually has no regular budgetary allowance. Instead, they rely on grant proposals and other requests to the central government or county government to fund special, short term projects.

To operationalize our definitions of sustainability and resilience, we adopted qualitative indicators that specifically point to their differences (Table 4). The differences are not in the subject categories (such as

community education and economic development), but in the perspective and goals that the community seeks within each category. Based on our definitions (above), sustainability goals are conservation and mitigation oriented, while those of resilience are innovation and adaptation oriented. The orientation is reflected through public policies and programs. In addition, none of the options shown are new models or ways of doing things. Communities and other social groups have always had to making decisions along these lines. When a community development issue arises, the basic questions are: "What do we conserve or protect from change?" and "What do we innovate or allow to change?". How we conserve and innovate are, of course, also crucial questions in this context.

<< Table 4 About Here - Sustainability and resilience indicators. >>

Table 5 summarizes the sustainability and resilience policies and programs that we found in rural tourism communities in Taiwan. It summarizes and compares them for the three communities that had experienced disasters in recent memory, and the five non-disaster experienced communities, using the indicator guideline from Table 4, although some of the categories are combined where appropriate. The results reflect both public policy options that the communities have taken, and the outcomes of some of those options. Policy options are driven by a combination of the types of central government and county programs that are available to village communities, and the preferences within the villages as to which programs they will apply for, based on the limited resource that many of them have.

<< Table 5 About Here - Sustainability and resilience indicators for disaster and non-disaster experienced tourism communities in rural Taiwan. >>

In terms of economic sustainability, both disaster and non-disaster experienced communities (hereafter referred to as "disaster communities" and "non-disaster communities", respectively) had very low rates of unemployment, with respondents often commenting that anyone who wants a job can likely find one locally. Poverty is also not an issue in any of the communities studied. However, the disaster communities clearly had stronger economies overall, both in tourism and in their more traditional agricultural activities. This contributed to lower rates of younger people migrating to larger cities for employment than was the case in non-disaster communities. Economic sustainability (defined as the efficient and non-wasteful use of natural resources; Lubin & Etsy, 2010) was, therefore, more robust in the disaster communities studied. This situation is mostly likely due to the resilience measures taken by disaster communities in terms of economic development. These communities devote a much larger percentage of their local revenue to economic development, much of which is focused on developing tourism in different ways (accommodations, food, interpretation, recreation) to diversify their economic options. The high tourism employment percentage for these communities is a reflection of this resilience building diversification.

The leisure agricultural programs of the Council of Agriculture (Executive Yuan, R.O.C.) are possibly the most important long-term resilience building policies that was encountered in the study. They were in place in the two agricultural communities studied (one a disaster community and the other a non-disaster community). Taiwan's agricultural sector is not able to compete with lower wage countries, which then requires subsidies from the central government to enable farmers to survive. The Leisure Agricultural Area program, in particular, is helping areas that apply for funding under it to re-brand themselves as recreation and tourism destinations for Taiwan's urban populations. These areas are more likely to grow higher value organic and specialty crops and visitors are more likely able to meet the farmers and buy directly from them, both in-person and online. The program has a strong educational component to teach farmers how to brand themselves in these ways and how to market online.

In interpreting the budgetary spending rates in Table 5, it is important to recognize that average annual budgets for disaster communities were five times higher than that of non-disaster communities (US$152,000 compared to US$29,000). Spending rates shown are the percentage of total budget spent on each category. Because local village budgets are mainly based on successful grant applications to specific programs, they vary considerably from one year to the next. The averages shown here were based on the current and previous one to two years for communities in each grouping. The significance of this difference is discussed in greater detail below.

In terms of local knowledge, sustainability approaches are very strong in both disaster and non-disaster communities, as reflected in comparably high rates of environmental knowledge and fairly high use of natural resources obtained from the environment (excluding gardening and farming). Traditional religious practices were extremely high in all of the communities interviewed which reflects the strength of traditional Chinese religion (a combination of Taoism and Buddhism) across Taiwan (Hu & Yang, 2014). From a resilience perspective, however, disaster communities were much more likely to engage their residents with different forms of formal education than were non-disaster communities. Education is a key component in building resilience because it fosters problem-solving, creativity, and innovation in adapting or transforming to changing conditions (Walker et al., 2004; Berkes, 2007; Strunz, 2012).

For environmental sustainability, non-disaster communities devote twice as much of their budgets to environment conservation and environmental education efforts than do disaster communities. However, when the much higher total budgets of disaster communities are taken into account, disaster communities are seen to spend twice as many dollars on environmental sustainability initiatives. Thus, it is generally safe to say that environmental sustainability is a significant value shared across all of the communities in rural Taiwan. From a resilience perspective, all of the communities in which agriculture was a major practice (which excluded the wetland and island villages) have experienced some changes in the types of crops that they plant, which reflects slow change in both environment conditions (climate change), in the domestic tourism market, and in the global agricultural economy. Overall, we did not encounter any major differences between disaster and non-disaster communities in terms of environmental sustainability and resilience.

This lack of difference between the two community groups was also true for health care when total budget dollars are taken into account. Health care is mostly provided through counties in Taiwan and supported by easily obtained grants from county governments. On the other hand, spending on infrastructure was significantly different with disaster communities devoting a much higher percentage of the budgets and an even higher total dollar amount to the upgrading and maintenance of roads and utilities, which is a sustainability approach to infrastructure. The much higher budgets in disaster communities is a reflection of their greater infrastructure needs due to their more precarious geographies that makes the more susceptible to disaster in the first place.

Infrastructure strengthening is referred to as 'engineering resilience' in the resilience literature (Holling 1973; Pimm 1984) and is conceptually much more narrowly defined than are ideas related to social-ecological resilience. Based on our indicators (Table 4), engineering resilience is of form of sustainability when the focus is on strengthening existing infrastructure. It would a resilience indicator if the focus were instead on building redundancies and options into the system. Based on this, the disaster communities appear to have more sustainable infrastructure systems, although this can only be measured by how well it responds to the next disaster.

In summary, sustainability policies and outcomes were found to be mostly comparable across those communities that have experienced natural disasters than those who have not. Resilience policies and practices were much stronger in the natural disaster communities, mostly in the areas of economic development and formal community education. It may be that the other areas (environmental management, infrastructure and health care) are not good indicators of community resilience because, at least in the Taiwan cases, they are either too dependent on the distinct geographies of a place or are too uniform across the political landscape due to central government policies.

Not reflected in the numbers, but evident in interviews was a much higher degree of collaboration and cooperation in disaster communities, as well as higher levels of entrepreneurship and forward vision. These less definable characteristics appear to be a direct result of the disaster experience which all of the interviewees in the three communities considered a turning point in their development. While such an appraisal is unlikely in every post-disaster instance, these specific cases experienced positive outcomes due to:

- Special post-disaster recovery funding from the central government for 20 months which provided better knowledge of government funding programs and the application processes after the disaster;
- Higher levels of community cooperation, shared vision and willingness to innovate after the disaster experience;
- Greater general awareness and identification with communities across Taiwan and abroad that have had similar disaster and recovery experiences; and
- New opportunities for some entrepreneurs following the destruction of their buildings and businesses.

Tourism Discussion

Although not a specific focus of the research cited above, tourism was a significant development concern in all the communities that were interviewed, and the results provided insight into potential relationships between tourism development and community resilience. In rural Taiwan, as in many other parts of the world, rural landscapes are being transformed by a new "Romanticism" among the ever increasing numbers of urban residents who see them as a domain of escape and rejuvenation (Urry, 2996; Garrod, Wornell & Youell, 2006; Knudsen & Greer, 2011). Both natural disaster and non-disaster experienced communities in Taiwan have made tourism a key component in their local economic revitalization plans, encouraged by the central government and in response to growing domestic and international tourist arrivals. In our sample, the natural disaster communities clearly had greater success in developing tourism.

The disaster experience offered opportunities for individuals and communities to innovate as they were less bound by the legacies of the past path-dependencies. For example, Ruili is a disaster community in the Alishan mountain scenic area that was hit by both the 921 Earthquake in 1999 and massive flooding and landslides from Typhoon Morakot in 2009. Its traditional economy is based on tea production which continues to be a significant source of wealth for many of its residents. Tourism is also prevalent in Ruili, primarily through the 39 bed and breakfast establishments that operate there. In general, the more a business person is involved in tourism, the more they appear to have a desire to see the community work together as a whole. Those who operate solely in the tea sector were more focused on their individual work activities and sometimes expressed annoyances about visiting tourists. Tourism entrepreneurs (many of whom also grow tea) were focused on the special sense of place that tea created for Ruili, and initiated training in the traditional tea ceremony for local residents as a way to strengthen that sense of place. At the same time, there was also more awareness of disaster issues because their sector was more susceptible to declines in tourist arrivals due to damaged infrastructure. Tea plantations, on the other hand, have high physical resilience to both typhoon flooding and earthquakes.

Communities like Ruili exhibited many of the characteristics identified as indicators of both community resilience and sustainability. Sustainability is seen in their care for the traditional tea economy and recovery or traditional tea culture (which had been largely lost for most residents). Resilience is seen in their innovation and diversification, including various educational initiatives that are particularly strong within the tourism sector (Tsai et al., 2016). This is complemented by government programs to support environmental sustainability. The natural environment, which is also seen as a tourism resource, includes hiking trails and the nighttime viewing of fireflies and flying squirrels. In this way, the most successful rural communities in our study had indicators showing both a high degree of resilience and high degree of sustainability (Peirce, Budd & Lovrich, 2011).

Conclusions: Sustainable and Resilient Communities

Sustainability (mitigating against change) and resilience (embracing change) are not new ideas and are at the core of policy decisions that people and communities make all the time. Sustainability has become the major development paradigm throughout the world since it was introduced in 1987. For most of that time, the only alternative to sustainability was "unsustainability", which was usually attributed to neoliberal (free market) economic policies that over exploited limited human and natural resources. The growing interest in resilience as an alternative approach to understanding contemporary development issues is based on the belief that it is different from sustainability and that it does not carry the negative baggage of neoliberalism. Resilience is thought to be able to achieve roughly similar results to sustainable development at a time when climate change appears to be overwhelming sustainability efforts to control it. This may be true, but unfortunately, because many are not aware of the subtle differences in goals and impacts of these two approaches, the terms 'sustainability' and 'resilience' are often misunderstood and misused.

At their most simplistic definitions, sustainability and resilience are almost identical in meaning (Table 3). On the other hand, their most complex definitions can be meaningless in their complexity and all-inclusiveness. We adopted moderate definitions that point out how very different sustainability and resilience approaches can be in terms of their assumptions, goals, research focus and implementation methods. What they share in common is a desire to improve the quality of life of communities. In essence, they provide two different mechanisms for what are often perceived as two very different problems: intermittent fast change disasters and persistent slow changes. The comparison of disaster experienced communities and non-disaster experienced communities shows that sustainability is a component of both types of communities, partly driven by their need to respond to the common slow changes that affect all rural communities (Lew, 2014). This was seen in the non-disaster experienced communities spending higher percentages of their local budget funds for environmental protection and environmental education, and community health (Table 5). It may also be implied by their lower levels in characteristics that were more resilience oriented.

Sustainability, therefore, is seen to be the development path of choice for addressing slow variable changes, such as economic globalization and climate change. Sustainability responses are also partly driven by the larger institutional context that operate within and make up government policies and programs. This finding (that policies and actions to address slow change are primarily aligned with the sustainability approach) has not been addressed in a significant way in the resilience literature. Tobin (1999) referred to this association by equating most disaster planning actions prior to a major event with sustainability. Similarly, Redman (2014) defined sustainability as "adaptation" and resilience as "transformation". Within the sustainability adaptation approach, he included incremental change, maintaining previous order, and building adaptive capacity as key measures. This approach recognizes sustainability as pure mitigation and conservation is essentially impossible in a world that is undergoing continuous non-linear change. However, it does not recognize the political differences between policies of conservation and those of adaptation which could make an adaptation approach to sustainability untenable. We contend that sustainability offers one approach to addressing slow change issues and resilience offers another.

As evidenced in our fieldwork in rural Taiwan, what made disaster experienced communities stand out was the strength of their resilience orientation, developed and strengthened as a result of their disaster

experience. Based on the indicators in Table 4, the disaster experienced communities had higher levels of the following resilience characteristics (Table 5):

- They had actively built more diversified economies, mostly through the addition of a tourism economy to their traditional agricultural economy, which enabled more local youths to stay and work within the rural villages.

- While their overall rates of natural resource knowledge and use were no different, the disaster experienced communities had considerably higher rates of formal environmental, agricultural, disaster education.

- They had higher total budgets and higher rates spending and total spending amounts on infrastructure, although these could, to some degree, be due to their more precarious natural hazard locations.

The disaster experienced communities have learned through experience that building resilience is an effective approach to addressing fast change events. The question that remains is how to assist non-disaster communities to both maintain their sustainability orientation, and to strengthen their resilience. Many government and non-governmental programs already support sustainability initiatives due to its dominance in global development debates (Lubin & Etsy, 2010). Having more government programs that incentivize resilience planning (such as Taiwan's leisure agricultural programs) can help bring more communities to the preferred state of being both resilient and sustainable. But that can only occur if adequate funding and political leadership encourages resilience in the same way that sustainability has been supported. Only in this way can communities be best prepared for the complexity of change in the world today.

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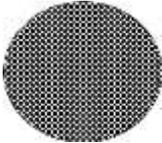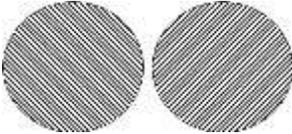
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Table 1. Possible relationships between sustainability and resilience.

	Relationship	Descriptions
	Sustainability = Resilience	Resilience as a system science view of sustainability (Adger, 2003) A resilient socio-ecological system is synonymous with a region that is ecologically, economically, and socially sustainable (Holling & Walker, 2003: 1)
	Resilience ⊂ Sustainability	Sustainability is the broad social goal and resilience is how it can be implemented (Farrell & Twining-Ward; 2005; Fiksel, 2006; Anderies, et al. 2013) Resilience is an indicator of sustainability (Walker & Salt, 2006; Schianetz & Kavanagh, 2008; Magis, 2010)
	Sustainability ⊂ Resilience	Resilience describes the overall condition of the system; sustainability provides a normative goal for system resilience (Derissen et al., 2011; Peirce, Budd & Lovrich 2011; Strunz 2012) Resilience is the base criterion for sustainable development and resources use (Adger, 1997; Perrings, 2006: 418)
	Sustainability ≠ Resilience	Sustainability mitigates change by maintaining resources above normative safe level; resilience adapts to change by building capacities to return to a desired state following a disruption (Tobin, 1999; Simmie & Martin, 2010; Davoudi, 2012)
	Sustainability ∩ Resilience	Pure resilience is descriptive and pure sustainability is normative, but with degrees of overlap when integrated (Brand & Jax, 2007; Derissen, et al., 2011)
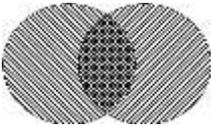
Source: Lew, Ng, Wu, and Ni (2016).

Table 2. Similarities and Differences in the Assumptions and Goals of Sustainability and Resilience.

SIMILARITIES	SUSTAINABILITY AND RESILIENCE	
Assumptions	Human societies and natural environments are deeply linked in a single social-ecological system; harmony between the human and natural parts of this system is possible	
Goals	System survivability; conservation of core resources ('slow controlling variables'); sense of place & belonging	
Research & Practice	Community development; climate change policies & actions; education & learning as an implementation tool	

DIFFERENCES	SUSTAINABILITY	RESILIENCE
Assumptions	Stability and balance are the norm (or are at least possible)	Nonlinear and unpredictable change and chaos are the norm
Goals	Normative ideals (culture, environment and economic balance, efficiency and equity)	Adaptive management; diverse and redundant systems; learning institutions; social capital
Research Foci	Environmental and social impacts of economic development; over use of resources; carbon footprints	Natural & human crisis/disaster management; climate change impacts; adaptive cycles; social capital & networks
Methods & Practice	Conservation & mitigation against change; resource restoration; recycling and 'greening'; education for behavior change	Reducing vulnerabilities & risk; increasing physical & social capacities for change (flexibility, redundancy & innovation); systems modeling
Criticisms	Radical and globalist agendas; highly contested politics & policies	Neoliberal agenda - 'personal change' over 'structural/governance change'; 'adaptation' over 'conservation'

Sources: Based on Adger, 1997; Fiksel, 2006; Brand & Jax, 2007; Prasad et al., 2009; Derissen et al., 2011; Magis, 2010; Redman, 2014; Lew, Ng, Ni & Wu, 2016.

Table 3. The range of complexity in definitions of sustainability and resilience, from simple to comprehensive.

Degree of Complexity	Simple	Moderate	Intermediate	Advanced	Comprehensive
Sustainability	Maintaining the Status Quo	Reducing Carbon Emissions & Recycling to Mitigate Climate Change	Protecting the Natural Environment from Decline	Conserving & Restoring Natural & Cultural Resources	Creating Fair & Equitable Well-Being for all Life on the Planet
Resilience	Strength or Toughness in Adverse Situations	Ability to Bounce Back from a Disturbance or Disaster	Capacity for Adaptation & Innovation in Response to Change & Disasters	Modeling Adaptive Cycles (temporal) & Panarchy (spatial) Responses to Change	Adaptive Management & Learning Institutions for Constant Change
Forms of Resilience	*Engineering Resilience*		*General Resilience*	*Ecological Resilience*	*Evolutionary Resilience*

Source: Lew, Ng, Wu, and Ni (2016).

TABLE 4. Sustainability and resilience indicators.

INDICATOR	SUSTAINABILITY GOALS	RESILIENCE GOALS
Economic Development	Improving economic efficiencies	Diversifying the economy
Community Education	Teaching traditional cultural knowledge	Teaching new & emerging skills
Environmental Education	Teaching traditional knowledge	Teaching science education
Environmental Management	Conservation and restoration	Adapting to environmental impacts
Infrastructure (roads, utilities)	Improving existing infrastructure	Creating diversified infrastructure options & redundancies (backups)
Health Care	Providing basic health care community-wide	Providing emergency or alternative health care

Source: Lew, Ng, Ni & Wu, 2016.

Table 5. Sustainability and resilience indicators for disaster and non-disaster experienced tourism communities in rural Taiwan.

INDICATOR	SUSTAINABILITY GOALS	RESILIENCE GOALS
Economic Development		
	Improving Economic Efficiencies	*Diversifying the Economy*
- Disaster Experienced Communities[1]	**Very low** unemployment rates (3%), poverty and income inequality; **Lower** rates of employment migration (24%); **Stronger** and better integrated economies in both the tourism and agriculture sectors[2]	**Much higher** rates of tourism employment (23%); **Higher** spending rates for economic development (11%); **Leisure Agricultural Area** programs in agricultural communities
- Non-Disaster Experienced Communities[1]	**Very low** unemployment rates (4%), poverty and income inequality; **Higher** rates of employment migration (36%); **Somewhat weaker** tourism and agricultural sectors[2]	**Lower** rates of tourism employment (5%); **Lower** spending rates for economic development (7%); **Leisure Agricultural Area** programs in agricultural communities
Community Education & Local Knowledge		
	Teaching Traditional Cultural & Environmental Knowledge	*Teaching New & Emerging Skills, and Science Education*
- Disaster Experienced Communities	**High** rates of traditional environmental knowledge (70%) and use of local environmental resources (31%); **High** rates of religious participation (99%)	**Much higher** rates of formal environmental (41%), agriculture (39%) and disaster (45%) education
- Non-Disaster Experienced Communities	**High** rates of traditional environmental knowledge (63%) and use of local environmental resources (37%); **High** rates of religious participation (99%)	**Lower** rates of formal environmental (12%), agriculture (19%) and disaster (13%) education
Environmental Management		
	Conservation and Restoration	*Adapting to Environmental Impacts*
- Disaster Experienced Communities	**Lower** spending rates for environmental protection (8%) and environmental education (6%), but **higher** total dollar amounts[3]	**Some** changes in crops cultivated in agricultural areas to adapt to climate, domestic tourism and global market changes

	Improving Existing infrastructure; Providing Basic Health Care	Creating Diversified Infrastructure Options & Redundancies (backups); Providing Emergency or Alternative Health Care
- Non-Disaster Experienced Communities	**Higher** spending rates for environmental protection (16%) and environmental education (14%), but **lower** total dollar amounts[3]	**Some** changes in crops cultivated in agricultural areas to adapt to climate, domestic tourism and global market changes
Infrastructure (roads, utilities) & Health Care		
	Improving Existing infrastructure; Providing Basic Health Care	*Creating Diversified Infrastructure Options & Redundancies (backups); Providing Emergency or Alternative Health Care*
- Disaster Experienced Communities	**Higher** spending rates for infrastructure (60%) for strengthening existing infrastructure; **Lower** spending rates for community health (5%)[3]	**Higher** spending rates for infrastructure (60%) – some of this is for developing alternative road options
- Non-Disaster Experienced Communities	**Lower** spending rates for infrastructure (35%); **Higher** spending rates for community health (10%)[3]	**Some** alternative health care programs in one community

Source: Authors
Notes:
1. Natural disaster experienced communities = 3; Non-disaster experienced communities = 5; percentages are for either resident or enrolled population, unless spending is mentioned in the description.
2. Although listed in the sustainability column, the assessment of overall economic strength is an overlapping variable that has implications for both sustainability and resilience, as discussed in the text.
3. Spending rates and total dollar amounts refer to village funds spent. Disaster experienced communities had average annual budgets that were five times higher than that of non-disaster experienced communities (US$152,000 compared to US$29,000). Spending rates shown are the percentage of total budget spent on each category.