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Local knowledge for Facilitating Adaptation to Climate Change in Asia and the Pacific:

Policy Implications

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Local Knowledge for Facilitating Adaptation to Climate Change in Asia and the Pacific: Policy Implications

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Abstract

Impacts of climate change are likely to be severe in the Asia-Pacific region but adaptive capacity is weak in most countries and communities. As much of the adaptation is site-specific and has to be developed at the individual and community level, it is crucial to harness local knowledge in designing adaptation strategies. Focus group interviews with diverse stakeholders including local people and policy makers over two years in Bangladesh showed that indigenous strategies still remain the most reliable and sustainable forms of coping with extreme climate events such as floods and droughts. However, local knowledge was rarely taken into consideration by policy makers in designing adaptation strategies and very few institutional mechanisms exist to mainstream traditional coping and adaptation mechanisms. Several indigenous measures to cope with climate extremes in various sectors (agriculture, forestry, animal husbandry, fisheries and water resources) are outlined here, and the guiding principles for integrating local knowledge in adaptation policy are discussed. It is concluded that a shift in paradigm from "top-down strategy" to a "bottom-up participatory approach" and designing a policy framework comprising both "scientific" and "indigenous" adaptations as well as "planned" and "autonomous" adaptations, is vital to facilitate future adaptation to climate change. Tools such as global positioning systems, geographic information systems, and relational databases can be used for integrating local knowledge in policy frameworks and in assessing both spatial and temporal impacts of different adaptation options. A spatial framework to integrate local knowledge in adaptation policy is outlined.

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1. Introduction

The IPCC Third Assessment Report 2001 concluded that current knowledge on adaptation to climate change, and adaptive capacity is limited and emphasized the need for further research on timely, progressive and viable adaptation measures. Further it stressed that adaptation to climate change, sustainable development and enhancement of equity are mutually reinforcing (IPCC, 2001). Most countries in the Asia-Pacific region are heavily dependent on climate-sensitive sectors (agriculture, fisheries, tourism, etc.) and are, therefore, more vulnerable to climate change than other regions. Climate modeling scenarios for Asia indeed predict warmer temperatures, drier soils, rising sea levels, higher frequency of floods and droughts, and consequent shifting patterns of resource availability. For example, floods and erosion have become central components of the life of *char* (unstable alluvial islands) dwellers in Bangladesh, as the islands can disappear into the river within a few days. On an average, a char-dweller aged 45 may have moved eight times because of erosion in Bangladesh (Schmuck-Widmann, 2001). The goal of climate change adaptation policies should be to enhance adaptive capacity and facilitate actions that reduce vulnerability and improve resilience of local people to climate change, which in turn can advance sustainable development and equity.

One of the promising methods to design socially benign and culturally appropriate adaptation policies is to document and understand local strategies to cope with climate change. This is in part because indigenous societies accumulated valuable knowledge that helps in understanding human-environment relationships for optimum utilization of resources and to regulate human environmental impacts (Kempton, 2001). A great deal of traditional and local knowledge already exists in Asia and the Pacific. For example, even in a small area covering 12 villages in Dindigul district of India, as many as 1203 indigenous agricultural practices were recorded (Sundaramari, 2001). Participants at a recently conducted workshop in 2005 on “Community level adaptation to climate change” in Bangladesh also stressed the importance of incorporating indigenous knowledge into adaptation strategies to climate change in developing countries (Hossain, 2005). Indigenous knowledge is not confined to developing countries alone. For example, Ainu tribes in Japan and Maori tribes in New

Zealand have reliable traditional knowledge related to their experiences with specific local areas. Policies during the recent past with a greater reliance on modern technologies, however, led to the loss of local knowledge over generations. For example, the widespread cultivation of high yielding varieties of rice made Bangladeshi farmers forget how to select and plant flood resistant local species.

The objective is to examine the relevance of local knowledge in facilitating adaptation to climate change, and propose means to integrate local knowledge in adaptation plans, using Bangladesh as a case study. After outlining the role of local knowledge and its recognition by international community, a summary of focus group interviews with various stakeholders in Bangladesh is provided. Some examples of local knowledge in various sectors are then provided as a basis for integration of such knowledge in adaptation plans.

2. Local knowledge in climate change adaptation

Local knowledge is variously referred to as folk knowledge, traditional knowledge, indigenous knowledge, traditional environmental knowledge, indigenous traditional knowledge, indigenous agricultural knowledge, farmers' knowledge, rural people's knowledge, peasants' knowledge, ethno-science, etc. It is based on experience, often tested over centuries of use, and entails many insights, perceptions and intuitions relating to local culture and the environment. It is both dynamic and complex, and is not confined to knowledge about uses and products but also about processes.

Indigenous knowledge for adaptation to climate change may be described as knowledge unique to a given culture or society, acquired through accumulation of experiences of local people (farmers, landless laborers, women, rural artisans, herders, etc.) through informal experiments and intimate understanding of the natural systems stressed by climate change and socio-economic development. Both climate change-related stresses such as global warming and socio-economic stresses such as changing lifestyles affect the natural systems. Because local communities have historically and continue to be guardians of these systems, they have developed novel ways of adapting to such stresses. Moreover, local knowledge embodies place-specific experience on climate change, so it allows better appraisal of climate risk factors in production decisions. Although adaptation largely occurs at micro-spatial scales and

is site-specific, adaptation plans so far neglected the micro-spatial scale in favor of the regional and national scales. In addition, there has often been too much reliance on top-down prescriptions and not enough understanding of local processes, priorities and the dynamics of local communities. Many experts acknowledge that shortcomings of some adaptation projects were primarily due to ignorance of local knowledge and failure to involve local communities and other stakeholders.

Since adaptation to climate change is a cyclical process involving information, planning, implementation and evaluation, indigenous knowledge is crucial in several phases of adaptation policy framework. These include vulnerability assessment, priority setting process, preliminary selection and evaluation of adaptation measures, designing implementation methods for various adaptation strategies, and integration with other adaptation and mitigation strategies. For example, Matamatega o Kaumana (MOK) is local knowledge in Tuvalu for reading of clouds to locate schools of fish in the ocean and to predict approaching disasters (strong winds, droughts, waves) and it can increase community preparedness for disasters associated with climate change (Faavae, personal communication).

2-1. International recognition of local knowledge in climate change adaptation

During the past decade, at least 10 declarations emphasizing indigenous knowledge were made internationally, starting with the Declaration on Environment and Development adopted together with Agenda 21 by the Rio Earth Summit in 1992. In Agenda 21, local knowledge was mentioned as many as 166 times. Since then, over 30 research institutes and archives on indigenous knowledge have been established all over the world. The Albuquerque declaration submitted to COP4 in Argentina is perhaps the first formal declaration emphasizing the need for respecting indigenous cultures and learning from their knowledge of climate change. Indigenous knowledge was also on the agenda of the first (Toronto, 1997) and second (Kuala Lumpur, 2000) conferences devoted to global knowledge for development. The International Indigenous Forums held in Lyon, Hague and Bonn in 1999, 2000 and 2001 respectively further stressed this point. The Scientific and Technical Advisory Panel of the Global Environment Facility, in their workshops in February and April 2002 also underscored the

importance of indigenous knowledge and local participation. Because of such initiatives, there is now an increasing appreciation by policy makers of the need to understand local perceptions of climate change problems and solutions.

2-2. Status of Utilization of Local Knowledge – A case study from Bangladesh

Bangladesh is one of the most highly disaster-prone countries of the world. Of all disasters, the problem of floods has aggravated most from 1955 to 2004 and became one of the main concerns of people in Bangladesh. Abnormal floods submerge about 60 percent of the land, damage crops and property, disrupt economic activities and result in diseases and loss of life. Participatory rural appraisals, focus group discussions, inter-generational dialogues, semi-structured interviews with local people and key informants in Bangladesh in flood-prone district of Mankiganj showed that indigenous strategies remain the dominant form of response to climate disasters. The frequency of use of different local coping strategies in various flood years is shown in Table 1. It appears that raising the plinth of homes is the most common form of response in terms of improving housing condition, and dietary changes accompanied by reduced food intake and using local methods of dry food storage were the most common strategies to survive in periods of flood. As most people don't own boats, the main form of transport was rafts lashed together with trunks of banana trees. The planting of reeds known as catkins (*Saccharum spontaneum*), an indigenous species well suited to sandy soils, is another local coping strategy to prevent soil erosion. While these methods appear inadequate and primitive, they are still considered the most effective forms of survival by local people.

Table 1: Historical matrix of coping strategies in times of flood, Manikganj, Bangladesh

Coping strategy	**2002**	**1998**	**1988**	**1981**
Improvement of housing condition				
(a) raising the plinth of homes	OOO	OO	OOOO	OOO
(b) constructing "manchans" (hanging bamboo platforms inside houses)	OO	O	OOO	O
Taking shelter in elevated grounds	O	O	OO	O
Selling land	O		OOO	O
Fuel storage	OO	O	OO	OO
Storing dry foods	OOO	OO	OOOO	OOO
Diet changes and reducing food intake	OOO	OO	OOOO	OOO
Banana plantation and bamboo propagation to be used as floating platforms and rafts for movements;	OO	O	OOO	OO
Growing catkin in sandy lands to prevent erosion	OOO	OO	OO	OO

Key for frequency:

OOOO very high OOO: High OO: Moderate O: low Blank: not used

3. Local knowledge for facilitating adaptation in selected sectors

To local people, knowledge is of importance only if it is necessary for their survival and for coping with daily problems. A wide range of indigenous adjustment or coping strategies, which may be divided into "intentional" and "incidental" strategies, is followed in several

regions. For example, the method of building huts to enable quick moves in the event of floods is said to be an “incidental” strategy. Adaptation strategies based on indigenous knowledge are largely concerned with natural systems including agriculture, forestry, fisheries, water resources, etc. Selected examples from various sectors are given below:

Agriculture*:* For many indigenous farmers, reducing risk from droughts and floods is more important than maximizing production. Indigenous coping strategies range from simple methods such as maintaining hardy wild foods (e.g., consumption of wild fruits and vegetables that survive during droughts) to more complex methods of reducing risk through cultivation of more than one type of grain staple, mixed land use, intercropping and mixed cropping. Adaptive capacity of such traditional mixed cropping and agro-forestry systems has been shown to be much higher than that of modern farming systems. Using local germplasm highly acclimated to withstand harsh climates is one innovative strategy. In Bangladesh, for example, local farmers grow several rice varieties that are adapted to depth of flooding.

Farmers in India base their cropping pattern decisions on Krishi Panchang (agricultural vedic calendar), which includes a climate forecast for an entire year based on planetary positions. Bio-dynamic agriculture, a system initiated by an Austrian philosopher, Rudolf Stiener, and practiced now in nearly 25 countries also depends on similar calendars. For example, farmers in Gujarat, India decide to cultivate groundnut and cotton if there is an early onset of rains, and pulses and millet if there is delayed onset. The scientific basis of some of these practices remains unclear however. For example, only recently Orlove et al. (2000) found out the basis of indigenous knowledge of potato farmers in the Andes, who usually forecast inter-annual variations in summer rainfall and in autumn harvests based on changes in the apparent brightness of stars in Pleiades around the time of the southern winter solstice. Farmers minimize the risk from low rainfall during the growing season in an El Nino year by varying the planting date.

In many parts of Asia, indigenous farmers evolved an intricate set of strategies to cope with heavy rainfall and landslides. In addition to re-terracing the collapsed slopes, changes in land use to match changes in slope stability and agricultural de-intensification are followed. In the mountainous regions of Nepal, for example, sloping lands are ploughed following a

bottom to top approach in a sword-like pattern to check sudden runoff and minimize soil erosion. Farmers in upland villages of Matalom, Philippines practice an indigenous soil conservation technique “cemento-cemento” or “Kahun-Kahun” to reduce the impact of heavy rainfall in areas with slopes ranging from 10 to 40%. Likewise, indigenous systems of rain water harvesting such as surangas (man-made caves for water) in Kasaragod district of Kerala, madakas (traditional percolation ponds) in coastal Karnataka, and johads in Rajasthan in India are unique ways to cope with droughts.

Local farmers also devised ingenious ways of dealing with climate extremes. Farmers in South India, for example, manipulate microclimate in betel vine gardens to produce high quality broad, light green, feathery leaves. Farmers dig long trenches (75 cm deep, 60 cm wide and 90 cm apart) and plant *Sesbania grandiflora* on the edges. Betel vine cuttings are planted when *Sesbania* plants are about 2 meters high and form a dense canopy that diffuses sunlight and provides cool climate. By impounding the trenches with water (60 cm deep) and by means of splash irrigation, the soil for the betel vine is always kept moist. In addition, dried banana leaves or plaited coconut leaves are placed around garden borders, thereby preventing the entry of hot air. The water in the trenches increases humidity within the garden. Likewise, farmers of Nubra valley in the western Himalayas grow grapes under severe, cold desert conditions by creating a warmer microclimate of the basin. This is achieved by filling pits with locally available crushed stone, bricks, grass, hay and soil, and by covering the vines with warm clothes, gunny bags or wooden baskets.

Forestry: In forestry too, local communities have adapted several strategies to cope with climate change. For example, community regulations such as ban on cutting certain types of trees (e.g., acacia, fruit trees) or religious decrees declaring certain trees as sacred are common in most Asian countries. These regulations are part of their efforts to maintain ecosystem health and to cope with unpredictable climates. Local people also have special knowledge on trees that could resist drought and die-back due to heat. Forest gardens in Java, Indonesia are another good example of indigenous coping strategy to climate extremes. They comprise nearly 15-50% of the total cultivated village land and represent permanent types of land use which provide a wide range of products with a high food value (e.g. fruits, vegetables, meat, eggs) and other products, such as firewood, timber and medicines.

Animal husbandry: In order to cope with droughts, farmers in the Indian subcontinent use jackfruit laves, sugarcane tops etc. as emergency fodder. Farmers in Hindu Khush region use indigenous systems (posilo-kam posilo and obano-chiso) for selecting and storing nutritious tree fodders to reduce drought risk on livestock. In Mongolia, farmers use local knowledge on animal fattening in summer and accustoming animals to winter cold.

Fisheries*:* Fishermen depend on local knowledge to determine the fish habitat and vary fishing methods. For example, a method called Kua fishing is widely popular in floodplain areas of Bangladesh. Soon after flood recedes, fish tend to find shelter in ditches. Kua owners use tree branches for better shelter and apply bran to attract fish.

Water resources: Char dwellers in Bangladesh build mounds and construct their dwellings to minimize damage from floods and plant catkin reed (*Saccharum spontaneum*) to protect chars from erosion. Catkin reed, which grows with the water level and survives floods, promotes stabilization of new land through fixing the fine, fertile sediments. In addition, it serves as the most important fodder during the monsoon season, fuel and building material. To prepare for a rise in the water level, the char people pay attention to signals given by climatic conditions and their bodies. They expect a water level rise in about a week after they observe clouds piling up like treetops, then flattening out in the following days and moving with strong winds for at least three days from South to North. In addition, char-dwellers report body feelings such as heavy sweating like fever, rheumatic pains and extraordinary exhaustion just before floods (Schmuck-Widmann, 2001).

Warabandi system of water allocation is a well-recognized practice to cope with droughts in many parts of India, Pakistan and Nepal. Water temples in Bali, Indonesia, are now widely recognized as indigenous strategies that contribute to a delicately balanced system of cooperation between neighboring farmers. Farmers follow water management guidelines and rigorous social coordination means devised by priests in water temples to optimize water sharing and minimize pest levels and to minimize damage from floods and drought.

4. Reasons for integrating indigenous knowledge in climate change adaptation policy

Considering the diversity, uniqueness, simplicity and prospects for wider adoption of indigenous coping strategies, the need for integrating them in adaptation plans is obvious. Some of the reasons are discussed below:

1. Indigenous knowledge is a powerful asset and social capital in many countries of Asia and the Pacific, which are vulnerable to climate change. Policies incorporating such knowledge are more likely to be acceptable and successful in the long run.

2. Both indigenous knowledge and climate change adaptation are site-specific. Moreover, indigenous knowledge is dynamic in the sense that people continue to generate new local knowledge on various coping strategies.

3. Indigenous coping strategies of local people resemble scientific methods in their reliance on systematic observation of natural phenomena. Indeed, many indigenous coping strategies which were once considered primitive and misguided are now seen as appropriate and sophisticated (Chambers, 1983).

4. Indigenous coping measures tightly link local knowledge, social responsibility and equity. Integration of such knowledge in adaptation plans can, therefore, address broader social concerns more effectively.

5. Both Indigenous knowledge and climate change adaptation are multi-level (individual, community, local, regional, national and international) and multi-sector endeavors. The adaptation options and strategies that we design must be, therefore, both proactive and reactive, relying on local experimentation and innovation, and community involvement.

6. Understanding local culture models and indigenous knowledge is essential for effectively communicating new strategies on climate change adaptation. Moreover, indigenous communication channels increase the rate of dissemination and utilization of adaptation strategies, as they provide mechanisms for facilitating understanding and communication.

7. The concept of integrating local knowledge in climate change adaptation plans fits well in the framework of sustainable development with 3E criteria– (environmentally sound, socially equitable, and economically efficient).

5. Guiding principles for integration

a. Bottom-up participatory approach:

Past results on adaptation policies indicate that local people did not adopt even the scientifically sound strategies suggested by researchers, as the transfer of results followed a top-down strategy. In this “take it or leave it” approach, the local person was largely a passive participant. A shift in paradigm from “top-down approach” to “bottom-up participatory approach” is, therefore, vital to improve adaptive capacity of people and for ensuring effective technology transfer. Decision making on selection of appropriate adaptation measures should be delegated to the lower levels of society. Another advantage with bottom up approach is that it entails relatively low cost.

b. Establishment of partnerships and collaborative processes:

Stakeholder collaboration should be initiated very early on in the panning process. Active participation by the local people who are most affected, and who accumulated knowledge on how to survive climate extremes is important to develop any practical and relevant climate change adaptation plans. Frequent informal meetings should be encouraged between policy makers, researchers, and local stakeholders. The partnership approach must involve local people at all stages of the technology development and policy formulation process, including the generation, dissemination and utilization of technology, as well as research planning, implementation and evaluation.

c. Win-win situations:

Integration of local knowledge in adaptation strategies should be a value-added approach and must benefit everyone involved thereby leading to win-win situations. It is also important to recognize and reward the holders of traditional knowledge for their invaluable contributions in climate change adaptation.

d. Demand-driven:

Integration should be demand driven. Prospects for integration of indigenous knowledge in climate change adaptation strategies must be identified at multiple scales (local, national, regional and global) and across multiple sectors (agriculture, forestry, fisheries, water resources, etc.) affected by climate change.

e. Sustainability dimension:

Integration philosophy should fit into the broader dimensions of sustainable development with concerns for equity, economy and environment.

f. Periodic assessment:

Impacts and benefits from integration of local knowledge must be assessed at regular intervals.

g. Outreach strategies and Technology transfer:

It is necessary to promote integration via workshops, round-tables, models and other assessment activities that combine information from the biophysical and socio-economic disciplines. Tools such as geographic information systems (GIS) should be used to accomplish integration but they must not be viewed as the ends. Modeling and GIS approaches should be complimented by direct interaction between policy makers and stakeholders to ensure incorporation of indigenous knowledge.

h. Capacity building and public awareness:

Implementing capacity building and public awareness campaigns is necessary. It is also important to document and preserve those measures that are cost-effective, and user-friendly. Wherever possible, such measures can be made available *ex situ* for wider adoption. Capacity building initiatives on adaptation should also include indigenous knowledge.

Integration of local knowledge in climate change adaptation policy, therefore, comprises the following steps:

1. Documentation of indigenous knowledge practices in a region

2. Awareness and observation of a particular indigenous strategy
3. Perception of the practice as a solution to adapt to or cope with climate change
4. Motivation to enhance adaptation using indigenous knowledge
5. Experimentation with local practice to facilitate climate change adaptation
6. Validation of the role of local practice in climate change adaptation
7. Evaluation of both indigenous and introduced strategies
8. Utilization and integration of the most suitable approaches in policies
9. Dissemination and popularization of coping strategies

6. A spatial framework for integrating indigenous knowledge

The advantages of using GIS to document, store and analyze local knowledge are well known. A spatial perspective not only allows examination of interactions between socio-economic, natural and human factors but also help us determine if some local practices from one area can be replicated in other similar environments. Using spatial information technologies, we may even be able to resurrect and/or reengineer indigenous strategies to fit projected climate variability and climate change scenarios in the coming decades. Spatial representation of indigenous knowledge relating to climate change adaptation is not easy however, as local knowledge has not been documented and geo-referenced in many parts of Asia and the Pacific. The first step is, therefore, to compile local knowledge using a matrix framework, and define and map the homogeneous spatial units with similar climate change issues. Local knowledge on climate change adaptation may be recorded and synthesized through formal survey questionnaires at the household level, interviews with selected local elders, and participant observation.

A historical matrix exercise can facilitate the identification of indigenous strategies to cope with climate extremes. For example, a group of elders in a local community can participate in a brainstorming session to list various coping strategies and identify the years when climate extremes have occurred. Each coping strategy may then be scored based on its

frequency of use. This task would tell us what local people did in the past during various climatic extremes, and what directions might be pursued in our search for alternative strategies. A portable GPS (Global Positioning System) may be used to record the positional readings of a local practice, when many villages and communities are surveyed. At this stage, local knowledge may be classified as per specific geographic regions, and into national, regional, community and individual levels.

Textual form of local knowledge can be recorded using data management software such as ICONS developed by the IUCN. ICONS, a Windows-based information management system, is specifically designed for indigenous knowledge and it basically uses a spreadsheet format to organize textual data. Text is classified into several modules, each of which represents a category (e.g. geographical area, community, etc.). Within each module, information is stored on records and sub-records, which are displayed in a form format showing various pre-set fields. External sources of data, such as word processor or GIS files can be attached to these records and sub-records and displayed as icons or as full representations. The attribute data in ICONS can then be linked to GIS software such as ArcView for conducting spatial analysis.

Spatial representation of various data layers in a GIS is likely to show apparent relationships between local knowledge on coping strategies and socio-economic and other conditions. The results from analysis must be reviewed on the basis of available documents (hard copies of maps) and other technical tools (expert systems). The outputs may ultimately take the form of a final geo-referenced adaptation plan at the community level, which can then be integrated in an overall policy framework. Some problems must be anticipated however. Policy planners concerned with climate change adaptation are primarily concerned with quantitative analyses of climate variability, where as indigenous studies often generate qualitative data requiring interpretative analysis. Also, indigenous strategies tend to be case-specific and it is not always easy to derive a generic model, which is sought after by policy makers for wider adoption in a region.

7. Concluding remarks

The overall goal of facilitating adaptation to climate change is to promote sustainable development through reducing vulnerability and facilitating the inherent resilience of people. It is worth remembering, however, that climate change is a global phenomenon while adaptation is largely site-specific. As site-specific issues require site-specific knowledge, indigenous bottom-up strategies are likely to be more successful than top-down approaches in adapting to and cope with climate change. Indeed successful adaptation activities are often built upon local knowledge. Despite such importance of local knowledge in enhancing adaptation, it has been largely ignored by policy makers due to inefficiencies arising from institutional weaknesses, over-emphasis of the public-sector, centralized decision-making and neglect of the central role of producer organizations, local communities and the importance of family farms over time. Indigenous knowledge systems were also considered to be inferior and denied role in designing policies. Inadequate consideration of different local practices was often blamed for poor success in introducing "scientific adaptations". The creation of a policy framework needed to adapt to and cope with climate change and to build resilience must, therefore, follow a bottom-up approach.

Insofar as the Asia-Pacific region is concerned, there is enormous potential for the use of local knowledge to enhance our understanding of adaptation strategies in different sectors. Optimal integration of local knowledge into climate change adaptation plans might also result in more culturally appropriate options, and present a more holistic and integrated perspective. Research on local knowledge for facilitating climate change adaptation requires relatively small resources but might yield a large dividend in furthering sustainable development. Technologies and tools such as GIS must be taken advantage of in integrating indigenous knowledge in adaptation plans. As per COP guidelines, adaptation activities are to be financed by three funds (The Kyoto Protocol Adaptation Fund, special climate change fund, LDC [Least developed country] fund) in addition to the Strategic Programme on Adaptation of the Global Environment Facility. It is recommended that these funds preferentially support projects that involve local people and integrate local knowledge in adaptation plans. .

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