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Twin Disasters

Forest damage from Cyclone Amphan.

Tracking COVID-19 and Cyclone Amphan's Impacts on SDGs in the Indian Sundarbans

by Malay Pramanik, Sylvia Szabo, Indrajit Pal, Parmeshwar Udmale, Jack O'Connor, Manas Sanyal, Souvanic Roy, and Zita Sebesvari

Bordering India and Bangladesh, the Sundarban Biosphere Reserve (21°32' N–22°40' N and 88°05' N–89°51' E, [Figure 1](#)) contains the world's largest contiguous mangrove forest and is a climate change vulnerability hotspot threatened by sea-level rise and frequent extreme weather events. In 2020 COVID-19 spread rapidly across the world, creating the worst global pandemic in recent memory.¹ Until vaccines are made much

more widely available, most countries have responded by imposing travel restrictions, curfews, quarantines, and closures of facilities and workplaces in an attempt to control transmission of the virus. In many cases, further waves of variant infections have set in. Strict lockdown measures have significantly disrupted the lives and livelihoods for the vast majority in the Sundarbans, particularly the economically weaker (mostly households dependent on daily wages from the informal economy) and otherwise vulnerable groups.² The

consequences of this pandemic are interacting with existing vulnerabilities and can be exacerbated by additional hazards such as coastal storms and cyclones.³

To add to its calamities, in May 2020 the region was hit by Cyclone Amphan. In West Bengal, Amphan caused an estimated damage of US\$13.0 billion, with the brunt of the damage occurring in the Sundarbans.⁴ It tore apart 4.5 million people's lives and livelihoods and destroyed 1.5 million dwellings.^{5,6} Moreover, 160 kilometers of embankments were

Figure 1. Map showing the location of the Sundarbans region and its physical surroundings.

Note. The shapefiles used for the map were open access provided by ESRI ArcGIS Online (2020). The map was generated using ESRI ArcMap 10.2.

breached by the storm surges and gusting winds, inundating thousands of acres of fertile agricultural lands with seawater, putting the capacity for future agricultural production at risk.⁵ The combined devastations of the pandemic and the cyclone are pushing communities in the Sundarbans to the limits of their resilience and coping capacities, demonstrating the need for urgent and integrated action to address the persistent systemic risks to the populations in the region.⁶

The Intergovernmental Panel on Climate Change (IPCC) (2007)⁷ warned that the Sundarbans region is endangered due to coastal inundation, climatic change, and the intensification of coastal storms and erosion.^{8,9} About 2.2 million people live below the poverty level, which is around

50% of the region's total population.¹⁰ Moreover, the fertility of the Sundarbans is degrading due to land conversion for aquaculture, agriculture, and erosion processes.^{9,11} The loss of the Sundarbans' extensive mangrove ecosystems further escalates disaster risk by increasing exposure and reducing coastal protection.¹² Due to the COVID-19 lockdown, about 80% of an average household's livelihood may be affected by the lack of income generated from aquaculture, agriculture, fisheries, and tourism.¹³ This case study explores the novel challenges for managing livelihoods and vulnerabilities in disaster-prone areas where the interconnected challenges of biodiversity loss and pandemics are predicted to increase in frequency.¹⁴

The United Nations (UN) 2030 Agenda for Sustainable Development sets out 17 Sustainable Development Goals (SDGs) to advance sustainable development globally, focusing on vulnerable and at risk regions. India has fully adopted the SDG framework and aligned its development priorities with the Global Goals; however, challenges remain in implementing the multifaceted framework in the context of such a large, culturally and economically diverse population. This has been brought into even starker relief since the advent of the COVID-19 pandemic. Accordingly, building resilience to future risks and recovering economic stability have been identified as key priorities by the Indian government.¹⁵ Indeed, the impacts of COVID-19 are expected to hinder the progress of the SDGs globally, even as

Figure 2. Conceptual framework showing the impact of preexisting risks on livelihood security in the Sundarbans regions.

recent statistics indicated they were already struggling to reach their targets.¹⁶

As the SDGs provide a valuable framework to advance local sustainable development priorities and monitor the effectiveness of their governance, they offer a useful lens through which to analyze how the impacts of multi-hazard risks will affect future local lives and livelihoods in the Sundarbans and in which sectors (e.g., health, economy and environment) these effects will hit the hardest. It is also important to note that the SDGs are designed to be achieved universally, with coherent synergies between interconnected goals. This provides a critical setting to forecast the multiple effects of the Amphan–COVID-19 events in both the short- and long-term futures of the Sundarbans.

In this article, we address the following questions: (1) What are the impacts of the COVID-19 lockdown and the Cyclone Amphan aftermath on delta dwellers and their livelihoods? (2) What are potential strategies to support livelihoods and food security in the face of continuing recurrent disruptions? (3) How are the consequences of the COVID-19 pandemic coupled with

Cyclone Amphan likely to affect progress toward achieving the SDGs at the local level?

We collected qualitative data using cross-sectional telephone interviews exploring the experiences of key informants, that is, livelihood collectors, and nongovernment organizations (NGOs). The insights from this study will contribute to the development of strategies and policy to mitigate multi-hazard impacts. Identification of policy implications will further contribute to designing policy options to minimize livelihood and food security threats in the world's biggest delta region. The conceptual framework of the present study (Figure 2) illustrates short- and long-term impacts of COVID-19 and Cyclone Amphan as a single multi-hazard event, considering preexisting risks in the region. It links logistics issues and market closures due to the COVID-19 lockdown to the vulnerability of livelihoods and food security in the region, and highlights the jeopardy to SDG progress in the Sundarbans and beyond. Finally, an outline of coordinated assessments, support, and alternate coping strategies to minimize multi-hazard impacts is explored.

Combined COVID-19 and Cyclone Amphan Impacts

Impact on Agriculture

In the Sundarbans, 4.4 million people are classified as marginal workers (who have guaranteed work for less than 6 months), like agricultural labor, cultivators, and household and daily wage workers.¹⁷ The major non-agricultural occupations in the region are in construction, driving, woodworking, and casual multipurpose labor. Due to the lockdown, many of the non-agricultural people lost their jobs or were forced to stop working due to lack of access to raw materials, further exacerbating their economic vulnerability.

A large number of households in the region depend on aquaculture and agriculture as primary sources of income.¹⁸ Farmers in the Sundarbans were almost ready for the rice harvesting season from June 2020 onward, having sustained significant economic losses due to Cyclone Bulbul during the previous November. The lockdown associated with COVID-19 delayed the paddy

Remains of a devastated shop, destroyed by Cyclone Amphan in West Bengal, India. Few structures could survive the storm.

harvest in the region due to labor shortages, logistic issues, and market closures. While the government declared an exemption of fisheries and agriculture from lockdown restrictions in first phase, there had been substantial lacuna in the implementation and delivery at the local level. Another important cash crop is betel vine. A large number of families in Sundarbans depend on betel vine cultivation. Cyclone Amphan destroyed most of the betel vine leaves (crops) and hampered the demand/supply chain during lockdown. According to a local farmer, “No one will try to invest in the next season of this crop” due to market closures and logistics issues.

Betel vine cultivators Subhas, age 64 years, and Bimal, age 52 years, observed:

I have five family members and betel leaf cultivation has been the primary and only source of

income and livelihood for our family. Only a few shops are opening for a restricted time, limited availability and high prices of materials like fertilizers, seeds, pesticides due to lack of supply. Market and travel restriction had already hit our family income. Amphan destroyed everything. I have to reconstruct the shed [locally known as “boroj”] to allow the betel leaves to regrow. The cost will be more than a lakh and I have to wait more than three months for the maturing of betel leaves, during which time I have no alternative income source.

Moreover, the farmers who hire agricultural workers to harvest paddy rice expressed their fear that if the lockdown continues, they might not be able to harvest because they do not know whether their workers will return after

COVID-19 restrictions begin to ease. The situation is likely to worsen in the medium future if people in the Sundarbans are unable to harvest.

Bimal noted:

Due to lockdown, I was unable to get any work and will only [be] able to manage food for [a] few days with small deposits of food grains and the rations provided by the state government. I have 1.3 bigha (0.81 acre) of agriculture land, but Amphan damaged this farmland and all standing crops with saline water. This land will not be suitable for cropping for at least 3–4 years.

Most of the shops in local markets are closed, and the prices of many essential food items have increased due to the interruption of the supply chain during lockdown. Many families do not have

enough food during this lean season, so their circumstances are dire (Figure 3).

Impacts on Aquaculture and Fishing

Aquaculture and fishing provide important livelihood options for many poor households in the Sundarbans region.¹⁹ In the inland fishery sector, West Bengal accounts for about 30% of the total fish and aquaculture production of the country. This is dominated by the production of North and South 24 Parganas districts in the Indian Sundarbans.

Complete lockdowns in the harbors and the fish landing centers have drastically affected the earnings of fishermen, an essential sector of food and nutritional security, in all coastal villages. During Cyclone Amphan the freshwater fishponds were flooded by saline water, which had a detrimental effect on fish production

lasting several months. Small-scale fisheries are especially responsible for providing fish as a substantial source of low-cost protein nutrition.

According to a report¹⁹ on the southwestern part of Sundarbans, particularly in Sagar block, the majority of the fish farmers (69% of aquaculture farmers) belong to low-income groups. As a result of lockdown, lack of access to markets, labor shortages, and various logistical issues make poor farmers even more vulnerable to the risks associated with fishing and aquaculture losses, which may subsequently affect trade and food security.²⁰ Aquaculture farm owners from Sagar block (Amit, age 39 years; Sukhendu, age 46 years; Subhankar, age 36 years; and Sanjib, age 35 years) expressed:

The sudden lockdown caused big losses for feed suppliers; I am fearful of farming this year because of

the limited availability of materials and labor, market inaccessibility, and the lands flooded by saline water by the Cyclone. Last year, the postlarvae trade had made a booming market, but this year the situation is dreadful. I fear that this year shrimp production will decrease considerably. It will be impossible to initiate farming next year, as I will not be able to pay my existing loans. Exports of shrimp to Europe and the United States have stopped and market fish prices have dropped, leading to considerable lowering of income.

Impact on Forest Product Collection and Tourism

Crabs and honey are major forest products that delta dwellers collect from the dense mangrove forests. The

Figure 3. Framework of multi-hazard impacts and policy responses, including recommended long-term actions, for the COVID-19 pandemic and Cyclone Amphan in the Indian Sundarbans region. White arrows indicate chronological sequence, yellow dashed arrows indicate systemic feedbacks, and green boxes indicate intended positive policy outcomes.

Damage from Cyclone Amphan.

region is home to a significant number of crab species, and some villagers depend on crab collection for their primary livelihood.²¹ Exports of crabs to prominent markets in China, Thailand, Malaysia, and Singapore ended in February 2020, and crab farm owners have been forced to shut down in the face of significant losses. This has compelled crab farmers to “sell locally with meager prices,” resulting in reductions of crab collection. Economic distress during lockdown has compelled many families to resort to crab collection from the deep forest (sometimes illegally), endangering collectors who had to contend with wildlife attacks.

A crab collector from Gosaba block (Manasi, age 34 years) expressed:

I have lost my main source of livelihood and family income from crab collection. Due to the lockdown, I could not go near to the forest to collect fish and crabs for more

than two and half months. Now this devastating Cyclone Amphan has destroyed my house and all belongings. I don't have any other alternate options to manage food for my family.

Another important livelihood option is tourism, which has also almost stopped for an indefinite period. Significant numbers of people in the Sundarbans are directly and indirectly associated with tourism as tourist guides, launch drivers, boat drivers, hotel workers, and restaurant staff who have no other means of livelihood. Most families face hunger, forcing delta dwellers toward alternative livelihoods such as seasonal honey collection from the mangrove forest. The local inhabitants may earn income by selling forest-based products such as honey, wax, and nipa palm at local markets.

A honey collector from Gosaba block (Ratan, age 51 years) said:

For honey collection, April to May is the best season, but this time I was not permitted to enter the mangrove forest due to the lockdown from early March. During the lockdown, I am getting some help from the government in the form of dal and rice. Nevertheless, this is not sufficient. Then the cyclone has hit us. My house and belongings are gone.

Honey is available year-round, and farmers can get higher, consistent income by harvesting wild honey. Many are collecting illegally without permits from forest officials, to supplement the “severe impacts on their yearly income.”

During the lockdown period a significant number of people were killed by tiger attacks at the time of livelihood collection, many of them migrant workers who recently returned home due to lockdown.²¹ When male members of the family enter the forest illegally, their tiger widows

Banana trees downed by Cyclone Amphan.

(*bagh-bidhobas*) are not entitled to any government compensation. Affected families rarely inform the authorities about the deaths of their family members engaged in illegal collection of honey. Overexploitation is, therefore, a distinct possibility. Figure 3 shows how the short- and long-term livelihood impacts of 2020 created long-term instability in the region.

Livelihood-Induced Poverty and Food Insecurity

The provision of ecosystem services is an important benefit of the Sundarbans and its adjacent buffer zone, in one of the wealthiest and most diverse areas of mangrove forests in the world. Due to interruptions of supply chains and market facilities, agriculture, crab collection, fishing, and aquaculture activities, many households have exhausted their food reserves so are dependent on the public food distribution system. Local people claim they are getting rice from the ration once a week, but that is hardly enough for the entire family. Moreover, there are many who still haven't received any rations and there are allegations of discrimination in the distribution of rations from the community and the administration.

The average monthly consumption expenditure per household in Sundarbans is approximately US\$30.²² The lockdown had almost turned into a humanitarian

disaster as the blockages of transport routes and negative economic impacts have been disrupting local food systems and obstructing fresh food supply chains, thereby increasing the risk of food waste and loss.²³ Many of these households are struggling to meet their food requirements due to inefficient government intervention at the village level.

The strain on scarce resources is exacerbated not only by the return of newly unemployed migrant workers, but migrant workers are also essentially trapped in the delta regions by imposed travel restrictions, and hence are unable to seek work in other states. Their future employment opportunities after COVID-19 are also uncertain. This has become a public safety issue, as unemployed people may become desperate in a context where local authorities and law enforcement are already stretched beyond their operational limit, leading to increased crime rates. Another public safety concern is the increased risk of suicide.²⁴

Cyclone Amphan destroyed thousands of houses and embankments, flooded large areas of agricultural land with saltwater, and destroyed crops and decimated livelihoods. Saline water intrusion may cause conversion of agriculture land to fallow land or brackish water aquaculture farming (e.g., prawn and shrimp), resulting into the loss of potential agricultural land.¹⁰ This

preexisting vulnerability means that the COVID-19 lockdown and Amphan consequences compound rising unemployment, falling investment, falling consumption, and long-term agricultural decline.

COVID-19 and Amphan Impact on SDG Progress at the Local Level

The multi-hazard impacts of COVID-19 and Cyclone Amphan should also be considered in terms of their effect on sustainable development in the Sundarbans, influencing progress toward the SDGs at the local level. The number of people living with acute food insecurity across the world could almost double to 265 million because of the COVID-19 economic fallout.²⁵ Despite some significant progress on certain SDGs, the South Asia region is predicted to fall short of reaching any of the 17 SDGs by 2030 without extra interventions, and some goals show backsliding rather than progress (e.g., SDG 12—sustainable consumption and production).²⁶

The most obvious SDGs likely to suffer setbacks to progress in the Sundarbans are SDG 1 (no poverty) and SDG 2 (zero hunger), as economic security and food security in the region remain tenuous. SDG implementation at the local level is still in the early stages in India, with action plans and monitoring frameworks still under development below the state level.¹⁵ This reduces the capacity to assess cumulative impacts on sustainable development across sectoral data gathering and reporting. In order to better understand localized impacts, SDG implementation must be prioritized to ensure that appropriate monitoring approaches are in place and that sustainable development priorities are tailored to the specific challenges of local communities in the region.

For example, the compound impacts of the COVID-19 pandemic and Cyclone Amphan on delta dwellers (Figure 3) highlights the need to build new perspectives on disaster risk reduction (DRR) in the context of multi-hazard risk into sustainable

Forest damage from Cyclone Amphan.

Trees uprooted by Cyclone Amphan.

development programs. This focus on resilience and sustainability of sustainable development can be complimented and integrated with the programs implemented by the Indian government focusing on economic resilience through investment in industry, technology and infrastructure. But recovery efforts should also incorporate the protection of ecosystems, providing ecosystem services, the maintenance of embankments to mitigate increasing salt-water intrusion, and the protection of local cultural heritage.¹⁵

Much-needed resources, previously earmarked for sustainable development programs, are likely to be redirected toward responses to the COVID-19. It is also critical to monitor and assess the efficacy and impacts of the COVID-19 response efforts themselves, which have escalated plastic waste pollution and provide contradictory approaches to social distancing.²⁷ In this state of policy flux, progressive policy measures such as climate action (SDG 13) and international supply chains (affecting SDGs 2, 7, 8, 17) may be reduced.

Policy Implications

The Sundarbans currently deliver inadequate scope for sustainable livelihood options.²⁸ Even though delta dwellers are experienced in dealing with natural hazards, the hits of Cyclone Bulbul and Cyclone Amphan intersecting with the impacts of the COVID-19 outbreak provide a new challenge for governments that have no cohesive plan for response or recovery. It is essential to recognize that in an economy where marginal or poor populations make up such a significant share, lockdown may have very different consequences from those in settings where people without income will be cared by social safety nets. The government of West Bengal had tried to control the pandemic spread by enforcing lockdown. However, food and income security have declined due to the pandemic, and the families with marginal, low-income workers were the worst hit. In the case of an extended lockdown period, these families will be unable to sustain agricultural practices,

further threatening their food and income security, thus making them more vulnerable. Therefore, providing secure and adequate supplies of food, sanitation, medical supplies, and health systems monitored for targeting is crucial.

If government relief does not reach the most vulnerable families in time, the status of food security and nutrition in the deltas may deteriorate to levels from which many will be unable to recover. Therefore, supplying and ensuring food is necessary through the provision of systematic food distribution centers. It is essential to have an emergency facility in every village hub where people can obtain food, bypassing the requirements of documentation, which impede the speed with which this response can be implemented. The government should take appropriate measures to minimize the lockdown impacts as well as risk, to lend a hand to save this extremely poor population from considerable food insecurity.

The lives of 4.5 million people in the region are tied to a fragile ecosystem's health, facing various environmental and socioeconomic threats. Farming, fishing, collecting honey, and tourism provide the few employment opportunities available. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) could be extended to cover harvesting operations in areas experiencing labor shortages. Resilience building can be coupled with the MGNREGA program. Resilience building is also necessary through development of new organizations, institutions, and processes to deal with future adverse consequences. Moreover, risk-informed developmental planning must be undertaken to create sustained change, including comprehensive and integrated analyses embracing the range and complexity of current and future overlapping threats and risks. In order to do this, we must switch from shortsighted, segmented planning and implementation to integrated transdisciplinary solutions that shape resilience and regenerate useful resources, thereby preventing both planned and unforeseeable negative outcomes.²⁹

The agricultural economy can be reestablished with phased lifting of lockdown restrictions in the delta region with proper vigilance to fulfill the basic needs of people. As reverse migration is taking place, the increased concentration of a potential labor force in the deltas may provide a resource for reestablishing agricultural activities and maintaining macroeconomic stability. This combination of highly productive land and availability of agricultural labor force in the delta region could help to sustain the food security and regional economy (Figure 3). Table 1 provides an overview of multi-hazard impacts, including preexisting environmental and socioeconomic risks on livelihoods in the Sundarbans. Strengthening supply chains is urgently required at the village level to improve the resilience of economic activities. In addition, empowering communities through the creation of local-level livelihood opportunities, infrastructure and transport developments, promoting ecotourism, and strengthening of self-help could help to minimize livelihood and other socioeconomic risks in the region. In addition to this, promoting participation of women in local governance, integration with communities, capacity building, and creating awareness about the values and threats are all critical for conserving the biodiversity and ecosystem services of the Sundarbans.

Conclusions

This article has surveyed the local livelihood impacts and monitored the progress of the Sustainable Development Goals during the aftermath of Cyclone Amphan under conditions of the COVID-19 pandemic. Although lockdown may help control the spread of COVID-19, it also impacts excessively the livelihood systems of the poorest residents in the Sundarbans. It is likely to have adverse medium- to long-term impacts on local livelihoods and local-level SDG progress. In addition to examining the impacts on livelihoods, this study also emphasizes the need to develop mitigation actions and response initiatives, including instituting pandemic

Table 1. The Short- and Long-Term Livelihood Impacts of Multi-Hazards in the Sundarbans and Related Policy Implications						
Livelihoods	Impacts Due to COVID-19		Impacts Due to Cyclone Amphan		Intervention and Policy Implications	
	Direct	Indirect	Direct	Indirect	Short to Medium Term	Long Term
Agriculture (rice)	<ul style="list-style-type: none"> ■ Delayed rice harvesting ■ Higher input cost ■ Limited availability 	<ul style="list-style-type: none"> ■ May reduce production ■ Higher production cost ■ Food crisis in the next year 	<ul style="list-style-type: none"> ■ Crop damages ■ Less area for cultivation ■ Saline water intrusion 	<ul style="list-style-type: none"> ■ Land conversion ■ Saline-induced long-term production decline 	<ul style="list-style-type: none"> ■ Secure and adequate supply of food* ■ Secure clean water supply ■ Ensure medical supplies and health system monitoring ■ Government subsidy to farmers ■ Extension of MGNREGA* ■ Tax relief to the farmers ■ Continuation of supply of materials to farmers* ■ Desalinization of ponds** 	<ul style="list-style-type: none"> ■ Provide technical support to land reclamation ■ Disaster resilience building ■ Mangrove plantation* ■ Embankment repair ■ Social safety nets ■ Reinforcement of agricultural economy ■ Maintaining macroeconomic stability ■ Reduce COVID-19 risk
Betel cultivation	<ul style="list-style-type: none"> ■ Stopped harvest 	<ul style="list-style-type: none"> ■ Loss of yearly family income 	<ul style="list-style-type: none"> ■ Damages and rotten of crops 	<ul style="list-style-type: none"> ■ Low yearly income 		
Aquaculture (inland)	<ul style="list-style-type: none"> ■ Less market accessibility ■ Production stopped 	<ul style="list-style-type: none"> ■ Yearly family income ■ Trade reduction 	<ul style="list-style-type: none"> ■ Collapsed embankments ■ Soil pollution 	<ul style="list-style-type: none"> ■ Less interest for the next season 		
Fishing (sea)	<ul style="list-style-type: none"> ■ Halted fishing ■ Disruption of planned activities 	<ul style="list-style-type: none"> ■ Income loss 	<ul style="list-style-type: none"> ■ Destroyed boat and launch ■ Harbor damaged ■ Pond salinity rise 	<ul style="list-style-type: none"> ■ Less income ■ Increase forest-dependent fishing 		
Crab collection	<ul style="list-style-type: none"> ■ Stopped crab collection 	<ul style="list-style-type: none"> ■ Yearly family income ■ Extreme poverty 	<ul style="list-style-type: none"> ■ Collection halted 	<ul style="list-style-type: none"> ■ Yearly family income ■ Extreme poverty 		
Honey collection	<ul style="list-style-type: none"> ■ Permit stopped ■ Small illegal collection ■ Death by tiger attack 	<ul style="list-style-type: none"> ■ Overexploitation ■ Income loss for most families 	<ul style="list-style-type: none"> ■ Stopped collection 	<ul style="list-style-type: none"> ■ Nil income for the year ■ Severe hunger issue 		
Tourism	<ul style="list-style-type: none"> ■ Stop tourism income ■ Stopped family earning 	<ul style="list-style-type: none"> ■ No earning for dependent families ■ Poverty 	<ul style="list-style-type: none"> ■ Very severely affected by Amphan due to total disruption in transport and electric supply over many days 	—		
Day labor	<ul style="list-style-type: none"> ■ Less family income ■ Less work availability 	<ul style="list-style-type: none"> ■ Rising unemployment ■ Potential starvation ■ Famine 	<ul style="list-style-type: none"> ■ Income stopped for a month ■ Potential starvation 	<ul style="list-style-type: none"> ■ Severe food crisis of the families ■ Social insecurity 		

*Indicates initiated government short-term intervention measures. ** Initiatives taken by local NGO.

phases, to build disaster resilience in the region.

There is still a great need to find ways to underpin livelihood support to local socioecological circumstances. Larger scale research on livelihood risks and socioeconomic realities in the context of multi-hazards in regions like the Sundarbans should be undertaken. We are witnessing a unique combination of extremely adverse and punishing circumstances for highly vulnerable populations. Necessary resources should be mobilized and policies implemented to prevent the long term impacts of the twin disasters.

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