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PATTERNS OF THE BIOSPHERE

RESEARCH FOR A SUSTAINABLE FUTURE
SUPPORTED BY SVENSKT TENN

DIVERSITY AND HARMONY

IN OUR GLOBAL HOME

TEXT BY ANDERS WALL

MY RELATIONSHIP WITH Svenskt Tenn dates back to the beginning of the 1950s, when I was a student at the Stockholm School of Economics. On the way to my rented room on Grevgatan, I often passed the Svenskt Tenn shop on Strandvägen with its attractive window displays. I occasionally popped into the shop to admire the beautiful products and their detail.

On one such occasion, *Estrid Ericson* came up to me and said that they had noticed that I often visited the shop but never bought anything. I explained that I was just a poor student. That conversation heralded the start of a friendship that lasted until Estrid's death and the start

of my engagement and responsibility for her life's work, Svenskt Tenn.

Our friendship deepened over time. During one of our lunches in her apartment on Strandvägen, she confided in me that she was thinking of selling Svenskt Tenn and that she had no shortage of prospective buyers. However, she was frightened at the thought of her creation being bought by someone who would not take care of it and of her interior design concept becoming just one of many in a large department store. If she were going to sell, it had to be to someone who could guarantee that the Svenskt Tenn brand and the tradition and quality it represented would survive. And thus

it came about that in 1975, *Estrid Ericson* sold her life's work, Svenskt Tenn, to the Kjell and Märta Beijer Foundation, of which I was chairman.

I am among those who consider it a great privilege for individuals and organisations with financial resources to be able to contribute to societal development. My old mentor *Kjell Beijer* was of the same opinion and through his donations he laid the cornerstone for a foundation supporting research within medicine and the environment. We subsequently amended the statutes to ensure that the foundation would work to preserve the Swedish interior design tradition.

Thanks to my dear friend *Stig Ramel*, then MD of the Nobel Foundation, the Royal Swedish Academy of Sciences (KVA) came to be involved from the start. In 1977 the Beijer Institute was founded at KVA and today it is one of the world's leading institutions for research into ecological economics. Many prominent researchers have links to the Beijer Institute. These include *Elinor Ostrom*, the Nobel prize-winner for Economics in 2009, who for a time was a member of the board and was active within many of the Institute's research programmes.

I am proud that we acted so early in promoting an area of research that is now of acute relevance. The Beijer Institute is creating new understandings of the links between humans and nature and our need for a healthy biosphere. For me, a farmer's son, this connection is abundantly clear.

There is a clear link between the Beijer Institute's aim of building a robust society with long-term sustainability and the quality and timeless beauty that characterise the Svenskt Tenn interior décor philosophy. Whether one mixes old and new, different styles of furniture, colours and patterns – objects that one loves will still blend together into a harmonious entity. This picture of a safe, harmonious and sustainable home interior also illustrates the concepts of biodiversity and resilience and their importance for the harmony of our global home.



PHOTO BY TOBIAS REGELL

THE ERA OF MANKIND

BE A TREE AND YOU WILL SEE

THE BIOSPHERE IS THE thin outer layer on this planet in which life exists. We humans are part of the biosphere and are completely dependent on the air, the seas, the forests and all other ecological systems in order to survive and thrive. Welfare and wellbeing are interwoven with the components of the biosphere in a complicated pattern of interactions.

Our species is successful. The number of people on Earth has doubled in half a century and through technological development and globalised trade, humans have become the greatest force for change

on the planet, with every inch of it's surface carrying traces of human activity. We have entered into a new geological epoch, the Anthropocene – The Age of Humans.

Changes in the environment sometimes take place slowly, in small, predictable steps, while in other cases they lead to sudden, shocking threshold effects. If we use our ingenuity and work together with the biosphere, mankind can become the force that gives coming generations the chance to live well within planetary boundaries.



Be a tree
and you
will see

Beskrivningen är det tunnast yttre skiktet på vår planet där det finns liv. Vi människor är en del av biosfären och helt beroende av luften, vatten, rygornas och alla andra ekologiska system för att leva och utvecklas. Växter och djur är sammankopplade med biosfären och bidrar till dess funktioner i ett inmutat nätverk av samverkan.

Vår art är framgångsrik. Antalet människor har fördubblats på 45 år och med bevarandepåslag och världsspännande hanterat har människans blivit den största förändringskraften på jorden, varje levande organism på vår planet har blivit påverkad av vår art. Vi har träd in i en ny geologisk epok, Antropocen - människans tid.

Utland står förändringar i miljö, i små flodsystem, i andra fall lever de tillräckligt och tillräckligt trädskador.

Om vi använder vår uppfattning och samarbetar med biosfären kan människans bli den som får som gör kommande generationer chansen att leva i ett annat planetens gränser.

Sven Eriksson, The Beijer Institute, Kungälv, Västra Götalands län.

WALDERSTEN

ILLUSTRATOR
JESPER WALDERSTEN

SINCE THE BEGINNING OF the 1800s, the world's population has increased from one billion to seven billion. During the same period, and particularly after the end of World War II, factors such as economic development, technological invention, new medicines and international cooperation have helped raise the standard of living and improve the health of an increasing proportion of people. Despite this, several billion still live in poverty. During this period of human development, the world's forests, lakes, seas and other ecosystems have unfortunately begun to show signs of serious damage. The year 2005 saw the publication of the first health check on the world's ecosystems, the UN Millennium Ecosystem Assessment, to which the Beijer Institute contributed through its research. The diagnosis was clear: mankind's rapidly increasing need for food, clean water, timber, fibres and fuel has altered the earth's ecosystems more rapidly and more severely in the past 70 years than in any previous age.

The UN report also brought some

good news. It helped confirm that humans and human societies are inseparable parts of the biosphere – the global ecological system that includes all life on Earth and in the atmosphere. The report also emphasised the importance of calculating the value of nature's goods and services. The conclusion was that combatting poverty and economic development are dependent on good management of ecosystems and their ability to provide us with essential services.

An attempt to produce scientific guidelines for better ecosystem management was made with the publication of the so-called 'planetary boundaries' in the journal *Nature* in 2009, with a follow-up in *Science* in 2015. This represents an attempt to define a 'safe operating space' for humanity through proposing boundaries that should not be exceeded if future development is to proceed in a safe way. Boundaries for seven critical planetary processes were proposed. Four boundaries, those for climate change, flows of nitrogen and

phosphorus, changes in land use and loss of biological diversity, already seem to have been exceeded. The other three are for ocean acidification, freshwater use and depletion of the ozone layer.

Nature is often subjected to gradual environmental impacts, such as slowly increasing nutrient concentrations or creeping losses of biological diversity. However, ecosystems do not always respond in a gradual way. Instead, they often become more vulnerable to sudden events, such as storms, floods and fires, that can cause them to tip over into a completely new state. A slow, stable process of change then suddenly becomes much more dramatic. This phenomenon is called a regime shift or tipping point. The consequences can be severe; important ecosystem services are lost and quality of life is affected. Moreover, there is often an inertia in the new system that makes it very difficult for nature to shift back.

This has happened many times of the course of Earth's history. Around 6000 years ago, the Sahara was covered

by forests, green plains, lakes and rivers. Through natural causes, the climate changed, first slowly but then the process became self-perpetuating. Eventually, rain more or less ceased to fall, which resulted in the Sahara

solar radiation will accumulate and it will become increasingly warm. The planetary boundaries have been set in order to avoid these types of large-scale, global tipping-points.

The increasingly strong links bet-

moving from the Holocene, the remarkably stable period in which our civilisations developed and thrived, into an age where mankind has itself become a global force that can change the whole world in its wake. The insight that we

Around 6000 years ago, the Sahara was covered by forests, green plains, lakes and rivers.

being transformed into an inhospitable desert at an accelerating pace. A current example is the Arctic ice cap, which is gradually thinning due to a warmer climate. The white surface of the ice reflects the sun's rays, cooling down the region, but if the ice disappears the

between human activities and the earth's life-supporting systems are reflected in the name Anthropocene, which is derived from anthropos, the Greek word for human. It is the name of the new geological era that many researchers believe we are now entering. We are

humans possess this power means that we are sitting in the driving seat and have the power to guide development in the right direction.



LOBSTERS AND HUMANS

A NETWORK OF LINKS

WITHIN ECOSYSTEMS, humans, animals, plants and microorganisms evolve and shape their habitats. In social-ecological systems, humans and nature are studied as one entity, where all societies are dependent on ecosystems and all nature is affected by humans. If they are studied separately, important interactions can be overlooked.

Resilience – the capacity of a system to deal with disruptions and live with change – is important in this context. It is essential in order for society and nature to develop together in a positive way in a rapidly changing world.

The gulf of Maine in North America

is known for its lobsters and is often referred to as a successful example of an economically and socially sustainable fishery where the lobster is not overfished.

Through cooperation and joint regulations, 7000 fishermen and many others living around the Gulf can earn a living from lobster fishing and supply the whole world with the ‘black gold of the sea’.

However, when this lobster fishery was studied from a social-ecological perspective, researchers found that practically all other species of fish had been fished out of existence.

The natural enemies of the lobster

had disappeared from the ecosystem, so the lobsters were able to expand in great numbers.

When too many lobsters live close together, they can easily develop diseases. A few dozen miles south of Maine, over 70% of the lobster population has already been killed off by a type of bacterial infection.

If people work together to increase biological diversity in the Gulf of Maine, they can restore variation in fish species and businesses. This would spread the risks and increase resilience.



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It can take up to three kilos of wild-caught fish to produce one kilo of farmed salmon and as much as 20 kilos to produce a kilo of farmed tuna.

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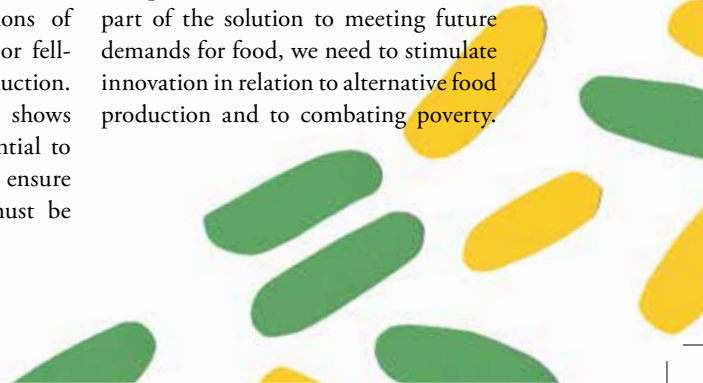
AS THE EXAMPLE OF lobster fishing in Maine shows, large-scale production of a single species, so-called monoculture, is seldom a good idea in the long term, even if the advantages of scale it provides can give economic benefits in the short term. This applies within agriculture, forestry and aquaculture, i.e., production of fish and shellfish, which is one of the Beijer Institute's research areas.

Aquaculture is often cited as an important component in feeding the world's growing population and as a way to counteract the dwindling fish stocks in the world's oceans. It is also the fastest growing sector within food production and now supplies almost half of all seafood we consume. However, it is sometimes forgotten that aquaculture

is dependent on resources from both agriculture and fishing. Modern aquaculture often takes the form of large monocultures and products such as soybean, fish meal and fish oil are commonly used in fish feed. It can take up to three kilos of wild-caught fish to produce one kilo of farmed salmon and as much as 20 kilos to produce a kilo of farmed tuna.

These large-scale cultures are susceptible to diseases and are associated with a number of environmental problems through eutrophication, emissions of pharmaceuticals and pesticides or felling of rainforest for soybean production. The Beijer Institute's research shows that aquaculture has great potential to increase food availability, but to ensure sustainable production there must be

more efficient use of resources, a lower environmental impact, improved certification and a greater diversity of species and culture methods. For example, fish farming could be combined with production of mussels and algae that live on the excess nutrients supplied in aquaculture and thereby clean the water. This would be a benefit not just for the environment but also for the fish farmer, who would have more products to sell and a less vulnerable production system. If aquaculture is to be a sustainable part of the solution to meeting future demands for food, we need to stimulate innovation in relation to alternative food production and to combating poverty.



THE BEIJER INSTITUTE AND

PATTERNS OF THE BIOSPHERE

TEXT BY CARL FOLKE - DIRECTOR OF THE BEIJER INSTITUTE

THE BEIJER INSTITUTE at the Royal Swedish Academy of Sciences is an international research centre, a cross-disciplinary institute at the interface of ecology and economics, that gathers leading researchers from around the world. The aim is to achieve a deeper understanding of the interactions between ecological systems and societal and economic development, which can help us to identify pathways to a sustainable future for humanity.

In our research programmes, ecologists, economists and other researchers are working together to answer questions such as: How can we develop our societies within the boundaries of the biosphere?

How can we make use of nature's services in an increasingly urbanised world? How can we capture the role of nature for our welfare in economic development? How can we manage the seas and develop aquaculture for fair and optimum use of the world's food resources? How can we enhance our ability to live with uncertainty in a world undergoing rapid change? How can people's behaviour contribute to a healthy environment and better human welfare?

The Beijer Institute's activities include international research programmes, workshops, teaching, capacity building and dissemination of research results.

The research has had an impact in

various ways within the research and education world. The results have also been taken up and implemented in practice within our entire society, for example in UN documents, EU decisions and national measures in different countries, and at local level in cities and companies.

The importance of the dynamics of nature and how we affect, are dependent on and can work together with these are at the core of our research. A fundamental concept in our research is that we as humans form part of the living biosphere and can influence it. Many new ideas have emerged from the Beijer Institute's research, examples being: natural capital, ecosystem services, ecological footprint,

**AN ARENA FOR KNOWLEDGE INNOVATION AND UNDERSTANDING
WHERE DIFFERENT RESEARCH AREAS CAN MEET.**

social-ecological systems, tipping points and resilience, which are described in this brochure. Another successful research institute, Stockholm Resilience Centre, was created by the Beijer Institute and it has also helped start a number of other platforms and international networks.

The Beijer Institute at the Royal Swedish Academy of Sciences was founded in the middle of the 1970s and changed direction in the early 1990s to focus on ecology and economics. Over the decades, the Kjell and Märta Beijer Foundation has provided the basic funding for the Beijer Institute. This represents a substantial and long-term investment in a research institute, not to find quick solutions to specific problems or issues, but as an arena for knowledge innovation and understanding where different research areas can meet. The support and engagement of

Anders Wall and the Beijer Foundation have been fundamental in this!

Here we are now at the opening of 'Patterns of the Biosphere' – a very inspirational meeting between art and science at Svenskt Tenn. The four artists, *Eric Ericson*, *Jesper Waldersten*, *Liselott Watkins* and *Stina Wirsén*, have interpreted central concepts and insights from the Beijer Institute's cross-disciplinary research in highly impressive ways. The collaboration with colleagues at Guringo and Svenskt Tenn has been very enriching and we have been able to watch a classic Josef Frank cabinet undergo a metamorphosis.

Together with 'Patterns of the Biosphere', another exhibition of science and art is being opened. This, 'Reflections of People and the Biosphere' at Raoul Wallenbergs Torg on Nybroplan, displays pictures from the book with the same name and shares many synergies

and an official opening with 'Patterns of the Biosphere'. The Beijer Foundation made all this possible!

We look forward to an eventful month and many new and exciting encounters.



PHOTO BY MIKAEL AXELSSON

PROFESSOR CARL FOLKE
DIRECTOR, THE BEIJER INSTITUTE,
ROYAL SWEDISH ACADEMY OF SCIENCES.
FOUNDING MEMBER AND SCIENTIFIC DIRECTOR
AT STOCKHOLM RESILIENCE CENTRE,
STOCKHOLM UNIVERSITY.

THE ART OF LIVING WITH CHANGE AND ADAPTING

FROM JOSEF FRANK'S classic cabinet, a sculpture has been created for the Patterns of the Biosphere exhibition. It interprets the scientific concept of resilience, which means the ability to live with change and to adapt. Resilience is something that can be built or cultivated, something that humans can practise.

The concept of resilience is captured in the cabinet's infinity symbol, which in research is called the adaptive cycle¹. It describes a four-phase dynamic process that many systems undergo – a time of

expansion, followed by a time of stagnation, a disruptive 'creative destruction' phase and then a time of renewal. Knowledge, understanding and experience are mobilised and combined in new ways. Through this, new development can continue along the same path or move to new paths. Slow and sudden changes interact. The model inspires dynamic thinking on development – in a person, an ecosystem, a company, a society or a whole culture.

Resilience is characterised by the fact that it involves interactions between

ecological and social systems and that it does not assume linear, predictable development. Strategies based on resilience mean that we must expect the unexpected and strengthen the ability of systems to adapt to future changes.

The resilience concept is an approach for analysing the major global changes we are facing. A better understanding of resilience in intertwined systems of humans and nature (social-ecological systems) is becoming increasingly important in dealing with the challenges posed

by climate change and other environmental impacts.

Resilience can be good or bad. Continuing along the current development pathway, refining and improving along the way, can lead us into a one-way street. Activities, societies and values risk being locked into a development trajectory that is difficult to escape when things suddenly change. The challenge then is being able to change paths, to find new ways. Sometimes, these shifts are beneficial, at other times they can be painful.

Resilience involves introducing flexibility and choice, handling uncertainty and complexity, being prepared for the unpredictable and having the capacity to turn crises into opportunities. It involves diversity and sustainability, something which is reflected in Svenskt Tenn's philosophy and the quality of its furniture.

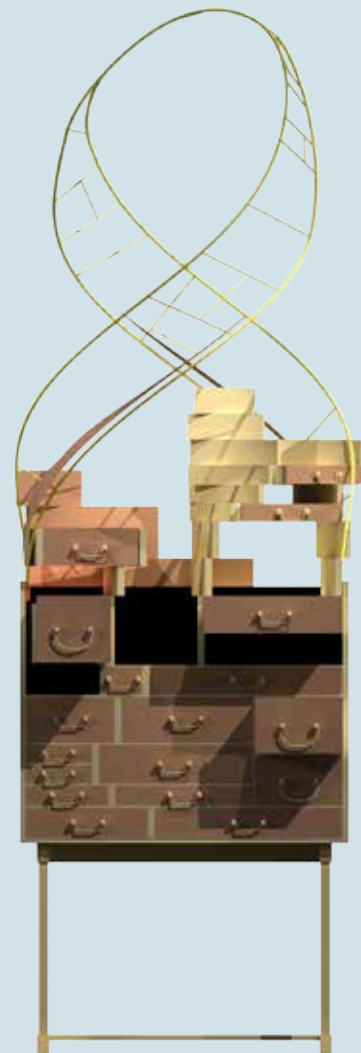
Research into resilience has grown rapidly and is now being conducted all over the world. The World Economic

Forum, the UN's high-level panel on sustainable development, aid work, crisis management and innovative thinking have all been inspired by resilience thinking. It was first developed at the Beijer Institute in the early 1990s, where the seeds were sown for the emergence of what is now Stockholm Resilience Centre¹¹.

¹CS HOLLING, a professor of ecology from Canada, is father to the resilience perspective and presented the adaptive cycle or 'Holling Figure-eight' in the mid-1980s.

¹¹STOCKHOLM RESILIENCE CENTRE is an international research centre at Stockholm University working in close collaboration with the Beijer Institute at the Royal Swedish Academy of Sciences.

DESIGN / INTERVENTION
JOSEF FRANK / GURINGO



INVISIBLE URBAN SERVICES

OVER HALF THE WORLD'S population now lives in cities. The number continues and 60% of the land that will be urbanised by 2030 has still not been built upon. Think of the opportunities that exist to create cities where people can feel well and prosper, that provide clean air and water and secure access to food – cities that are more self-supporting and interact with the surrounding landscape. Let us employ the help of nature's own services, the so-called ecosystem services, some of which have been personally and humorously interpreted by *Eric Ericson* in the adjoining illustration.

Ecosystem services are the multitude of services and functions supplied by ecosystems and their species to us humans. In cities, trees clear the air of particulate matter and exhaust fumes, reduce noise and provide shade, an increasingly

important service with future global warming. Birds spread seeds, insects pollinate crops and wild plants, and green areas absorb stormwater and prevent flooding. These are services which are expensive, or in some cases impossible, to replace through human efforts or technology. New York saved seven billion dollars by preserving an area of forest that filters the city's water instead of building a new larger water treatment plant.

Urban gardening is an increasingly popular re-invented activity that is not just a good hobby, but can also make a considerable contribution to food security in many countries. It is therefore regarded by the UN as an essential component in the fight against hunger. During World Wars I and II, vegetables were grown in parks, in back gardens and on railway embankments, football pitches

and roofs, in order to provide people with food. Such urban gardens also make it easier for animals and plants to spread from one patch to the next around the city.

By protecting ecosystem services and ensuring that they have a place in our cities, we can become healthier. There are many studies showing clear links between access to green areas and people's physical and mental health. Urban green areas provide spaces for exercise, recreation and quality of life, and strengthen our feeling of belonging with nature. Now that increasing numbers of people are becoming urban dwellers, we must give ourselves the chance to re-establish the bonds with nature and the biosphere in order to guide development towards a sustainable future. Urban ecosystem services can help us in that task.

EARTH HAS INVITED HUMANS

WELCOME TO THE BANQUET

EARTH HAS INVITED HUMANS to a great feast and has provided food, warm protective vegetation, water, power and beauty. However, the resources and services in our global ecosystem – the biosphere – are not limitless. They are natural capital that we must manage well, since economic development and ecological sustainability go hand in hand.

This is not always the case. Ecology and economics have long been studied as separate parts. Previously, ecologists studied natural ecosystems but saw only bushes, trees and animals – no humans. At the same time, economists sketched out social systems where nature was regarded as one resource among many,

a resource considered to be never-ending. The Beijer Institute invited both these groups to sit at the same table and to share meals and thoughts. When their world views were superimposed, new patterns which agreed much better with reality were able to emerge.

Research can involve identifying connections and patterns and developing theoretical models and concepts for use when knowledge is being put into practice. When we collaborate with each other, our ecosystems, and the unique biosphere in which we live, the feast can continue and there will be place at the table for all.

ECOSYSTEMS - forests, wetlands, fields, coasts, seas or grasslands – are living natural capital. This natural capital forms the basis for all other capital and, just like all other capital, needs to be actively managed if its value is to be maintained or increased. The value for us humans can be measured as welfare.

The Beijer Institute is working on the management of natural capital on several different fronts, including economic theory, food production, behavioural research and societal planning.

Green accounts is a collective term describing different ways of trying to capture the value of natural capital and ecosystem services in new measures of welfare that can act as a complement to GDP (Gross Domestic Product) and provide support in political decision making and business strategy.

The Beijer Institute's research shows that when people who are jointly managing natural capital such as fishing waters or grazing grounds acquire knowledge of threshold effects, they have the ability to work together to

prevent such effects occurring and to find better ways forward. This joint work often takes its starting point in crisis awareness, where knowledge and standpoints are tested and perspectives widened. This inspires hope and shows that it is possible to adjust activities and guide development in a more sustainable direction.



More and more examples are emerging from all corners of the earth of people working together across activities and sectors to manage natural capital in a better way – from local areas such as Kristianstad Vattenrike in Southern Sweden to regional large-scale ecosys-

tems such as the Great Barrier Reef in Australia and on to global collaboration on fish resources in the Antarctic Ocean. This type of collaboration acknowledges that the world and its ecosystems are in a state of continual change and that management methods must be adapted to this. Another important component is to coordinate all the parties involved in order to utilise the different types of knowledge available about the landscape and learn from one another, an example being the action introduced to save the Great Barrier Reef in Australia.

The Great Barrier Reef is the world's largest coral reef area and was long considered to be healthy and unaffected far away from the coast. However, the threats began to increase in several ways; fish species important for the reef's health were fished hard, the inflow of nutrients from agriculture increased and the rising water temperatures caused coral bleaching. Individuals, activities and organisations, such as local fishers, tourist guides, researchers,

Natur Naturkapital Ökonomi Ökologi

business owners and politicians on national level, came together and were mobilised to take on the challenge. Reef upkeep changed from having its focus solely on the coral reef to including the entire coastline and the surrounding landscape with its seventy different ecosystems. The main objective was to enhance the resilience of the coral reefs and their ability to adapt to change and to secure the many ecosystem services and the economic, cultural and social values that the Great Barrier Reef provides.

The possibilities of working with the natural capital instead of against it, of developing technologies and economies in partnership with the biosphere, are now crystallising. Sustainable development is how we manage our biosphere and our future together with everyone else on our planet.





KUNGL.
VETENSKAPS-
AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES



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