



REVERSING ENVIRONMENTAL DEGRADATION TRENDS  
IN THE SOUTH CHINA SEA AND GULF OF THAILAND  
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## CARRYING CAPACITY

CONCEPT FROM THE DISCIPLINES OF HUMAN  
GEOGRAPHY AND ECOLOGY

DEFINED AS:

*“The maximum number of individuals that, a given environment can support indefinitely, without detrimental effects to environmental state”.*



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## **CARRYING CAPACITY**

### **IF EXCEEDED THEN:**

- ORGANISMS MAY BECOME LOCALLY EXTINCT;**
- ENVIRONMENT MAY BE PERMANENTLY ALTERED OR DESTROYED.**

**Too many cattle – overgrazing, loss of vegetation cover irreversible changes to soil quality and productivity, which leads in turn to a reduced carrying capacity for livestock of the area concerned.**



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## **CARRYING CAPACITY**

**CHANGES FROM SEASON TO SEASON AND YEAR TO YEAR  
ACCORDING TO:**

**ABIOTIC ENVIRONMENTAL FACTORS SUCH AS, AMBIENT  
TEMPERATURE, RAINFALL, AND CLIMATIC EXTREMES; AND,  
BIOTIC FACTORS SUCH AS THE NUMBERS OF AVAILABLE  
FOOD SPECIES, PREDATORS OR COMPETITORS.**

**SOME FACTOR OR FACTORS, SUCH AS SPACE, FOOD  
AVAILABILITY, NUTRIENTS, AVAILABILITY OF NESTING SITES,  
OR TEMPERATURE DURING LARVAL STAGES OF GROWTH,  
LIMIT POPULATION GROWTH AND THESE LIMITING FACTORS  
VARY FROM YEAR TO YEAR.**



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## **CARRYING CAPACITY**

**POPULATION NUMBERS OF ANIMALS AND  
PLANTS ARE THEREFORE RARELY CONSTANT  
FROM YEAR TO YEAR, FLUCTUATING AROUND  
AN INTER-ANNUAL MEAN CARRYING CAPACITY  
THAT REFLECTS THE AVERAGE CONDITIONS  
OVER INTER-GENERATIONAL TIME SPANS.**



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## **CARRYING CAPACITY & LIMITING FACTORS**

### **PHYTOPLANKTON IN COASTAL WATERS:**

**NITROGEN, AND PHOSPHORUS THE PRIMARY LIMITING  
FACTORS IN SOME MARINE ENVIRONMENTS SILICON AND  
IRON**

### **BARNACLES & OYSTERS ON ROCKY SHORES**

**SPACE**

### **COLONIAL SEA BIRDS**

**NEST SITES**



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## **HUMAN CARRYING CAPACITY**

### **GEOGRAPHY - NOS OF PEOPLE PER UNIT AREA**

**EARLY STUDIES OF SUBSISTENCE COMMUNITIES THE ASSUMPTION WAS THAT FOOD “ENERGY” (I.E. CALORIES) WAS THE FACTOR THAT LIMITED THE GROWTH OF POPULATIONS.**

**SETTLED AGRICULTURE BASED ON PLANTING AND HARVESTING CROPS FOR CONSUMPTION, INCREASED THE AVAILABILITY OF FOOD ENERGY COMPARED WITH NOMADIC LIFE STYLES, AND DIFFERENT FOOD CROPS RESULTED IN DIFFERENT LEVELS OF POPULATION**



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## **HUMAN CARRYING CAPACITY**

**MAN AND BIOSPHERE PROGRAMME STUDIES OF THE  
“CARRYING CAPACITY” OF SMALL ISLAND SYSTEMS,  
SHOWED THAT FOR MANY ISLANDS THE POTENTIAL FOOD  
CALORIES THAT COULD BE GROWN WOULD HAVE  
SUPPORTED LARGER POPULATIONS THAN THOSE THAT  
WERE OBSERVED.**

**LIMITING FACTOR NOT FOOD ENERGY BUT PROTEIN AND  
WHERE DIETARY PROTEIN IS OF MARINE ORIGIN SULPHUR  
BEARING AMINO-ACIDS**



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## **HUMAN CARRYING CAPACITY**

**SPACE RARELY LIMITS HUMAN POPULATIONS AND WITH MODERN TECHNOLOGY MULTI-STORY “LIVING” RESULTS IN EXTREMELY HIGH, DENSITIES SUCH AS SOME SMALL ISLANDS WHICH EXCEED 120,000 PER SQUARE KILOMETER**

**SUCH CONCENTRATIONS MEAN THAT FOOD AND WATER MUST BE SUPPLIED FROM OUTSIDE THAT AREA WHICH HAS LED TO THE GEOGRAPHIC CONCEPT OF THE URBAN “FOOTPRINT” - THE TOTAL AREA OF LAND REQUIRED TO FEED, AND WATER, A CITY’S POPULATION.**





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## **HUMAN CARRYING CAPACITY**

**TOO MANY PEOPLE LEADS TO:**

**DISRUPTION OF ECOSYSTEMS LEADS TO:**

**ADVERSE SOCIAL AND ECONOMIC CONSEQUENCES.**

**SIMILARLY CHANGES IN THE ECONOMIC AND SOCIAL  
SUBSYSTEMS LEAD TO CHANGES IN THE ECOSYSTEM.**

**LACK OF KNOWLEDGE REGARDING ECOSYSTEM  
FUNCTIONING AND THE ECOLOGICAL LIMITS TO ECONOMIC  
AND SOCIAL ACTIVITY (I.E. CARRYING CAPACITY) HAS LED  
TO A GREATER ACCEPTANCE OF THE PRECAUTIONARY  
PRINCIPLE AND ITS USE TO GUIDE POLICY AND ACTION.**



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## HUMAN CARRYING CAPACITY

### OTHER APPLICATIONS OF THE CONCEPT OF CARRYING CAPACITY

***“ENVIRONMENTAL CARRYING CAPACITY”*** (ECC) MAY BE DEFINED AS THE AMOUNT OF CHANGE THAT A PROCESS OR VARIABLE MAY UNDERGO WITHIN AN ECOSYSTEM WITHOUT DRIVING THE STRUCTURE AND FUNCTION OF THE SYSTEM BEYOND ACCEPTABLE LIMITS.



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# **OTHER APPLICATIONS OF THE CONCEPT OF CARRYING CAPACITY**

## **ECOTOURISM**

**FOR EXAMPLE THE GREAT BARRIER MARINE PARK AUTHORITY  
HAS TRIED TO DEVELOP GUIDELINES REGARDING THE NUMBERS  
OF VISITORS THAT SHOULD BE PERMITTED ACCESS TO  
DIFFERENT PARTS OF THE SYSTEM INCLUDING THE BARRIER  
REEF ISLANDS BASED ON THE ECOLOGICAL/ENVIRONMENTAL  
IMPACTS OF VISITORS.**



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## OTHER APPLICATIONS OF THE CONCEPT OF CARRYING CAPACITY

### CARRYING CAPACITY WITH RESPECT TO CONTAMINANT LOADING

ABILITY OF THE ENVIRONMENTAL SYSTEM TO ASSIMILATE  
CONTAMINANTS WITHOUT DELETERIOUS OR  
UNACCEPTABLE LEVELS OF CHANGE (IMPACTS)

*“ASSIMILATIVE CAPACITY”* THE POLLUTION LITERATURE.

MEASURED IN TERMS OF THE MAXIMUM LOAD OF THE  
CONTAMINANT THAT CAN BE INTRODUCED WITHOUT  
OBSERVABLE, UNACCEPTABLE IMPACT ON THE BIOLOGICAL  
AND PHYSICO-CHEMICAL SYSTEMS THAT DEFINE THE  
NATURAL STATE OF THE WATER-BODY CONCERNED



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## **OTHER APPLICATIONS OF THE CONCEPT OF CARRYING CAPACITY**

### **CARRYING CAPACITY WITH RESPECT TO FISHING**

**NORMALLY CONSIDERED AS NUMBERS OF FISHERMEN  
AND THE SIZE OF CATCH THAT CAN BE SUPPORTED BY A  
PARTICULAR FISH STOCK OR STOCKS INDEFINITELY.**

**FISHERIES CONCEPT OF MAXIMUM SUSTAINABLE YIELD,  
TOTAL HARVEST THAT CAN BE MAINTAINED INDEFINITELY**

**UNFORTUNATELY DATA AND INFORMATION GENERALLY  
INSUFFICIENT TO ENABLE PREDICTION OF YIELDS OVER  
TIME SINCE THE ENVIRONMENTAL VARIABLES AFFECTING  
RECRUITMENT CHANGE INTER-ANNUALLY AND ARE NOT  
NECESSARILY AMENABLE TO PREDICTION OR MODELLING.**



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## **CARRYING CAPACITY**

### **AS A CONCEPT RELATES TO THE IDEAL OF SUSTAINABLE DEVELOPMENT**

**SUSTAINABLE DEVELOPMENT MEANS CHANGE WITHOUT  
UNNECESSARY LOSS OF ENVIRONMENTAL PRODUCTION,  
GOODS OR SERVICES**

**A KEY TO ACHIEVING SUSTAINABLE DEVELOPMENT IS  
THEREFORE AN UNDERSTANDING OF THE LIMITS TO GROWTH  
AND THE CAPACITY OF NATURAL SYSTEMS TO WITHSTAND  
CHANGE RESULTING FROM HUMAN ACTIONS.**