TD 01: Animal and plant agricultural production

TD 01 : Production agricole animale et végétale

1. Introduction:

Agricultural production must provide the necessary food for growing human beings (there are seven billion of us on earth since October "2011", and we will reach nine billion by "2015"). Since the 1950s, the modernization of agriculture has made it possible to increase food production, what induced negatives consequences on environment and health.

1. Introduction:

La production agricole doit fournir les aliments nécessaires à une population humaine en croissance (nous sommes sept milliards sur Terre depuis octobre 2011, et nous atteindrons neuf milliards en 2050). Depuis les années 1950, la modernisation de l'agriculture a permis d'augmenter la production alimentaire, ce qui a entraîné des conséquences négatives sur l'environnement et la santé.

2. Ecosystem and agrosystem:

- **An ecosystem**

An ecosystem is an association of a **biotope** (the environment with its physico-chemical characteristics: pH, temperature, humidity, etc.) and a **biocenosis** (all the living beings populating an environment and interacting with each other). Examples: a forest, a lake…

2. Écosystème et agrosystème :

- **Un écosystème**

Un écosystème est l'association d'un biotope (le milieu avec ses caractéristiques physico-chimiques : pH, température, humidité, etc.) et d'une biocénose (l'ensemble des êtres vivants peuplant un milieu et interagissant entre eux).

Exemples : une forêt, un lac, etc.

- **Primary productivity:**

Primary productivity is the mass of organic matter synthesized per hectare and per year, by chlorophyll plants (Autotrophic metabolism): they can synthesize, during photosynthesis, their own organic matter from light energy and initial mineral matter. The primary productivity

allows the functioning of all ecosystems because chlorophyll plants constitute the first links in all food chains.

• Productivité primaire :

La productivité primaire est la masse de matière organique synthétisée par hectare et par an par les plantes chlorophylliennes (métabolisme autotrophe). Elles sont capables de synthétiser, lors de la photosynthèse, leur propre matière organique à partir de l'énergie lumineuse et de matières minérales initiales. La productivité primaire permet le fonctionnement de tous les écosystèmes, car les plantes chlorophylliennes constituent le premier maillon de toutes les chaînes alimentaires.

- **An agrosystem:**

An agrosystem is a modified ecosystem (both the biotope and the biocenosis) and controlled by man for agricultural purposes. The primary productivity of an agrosystem determines its level (ratio between what a production actually brings and the means implemented to achieve this production). In an agrosystem, what is produced is generally exported to provide products used to feed humanity. A certain number of elements drawn by plants from the soil will therefore leave this modified ecosystem.

Un agrosystème :

Un agrosystème est un écosystème modifié (à la fois le biotope et la biocénose) et contrôlé par l'homme à des fins agricoles. La productivité primaire d'un agrosystème détermine son niveau (le rapport entre ce que la production apporte réellement et les moyens mis en œuvre pour atteindre cette production). Dans un agrosystème, ce qui est produit est généralement exporté afin de fournir des produits destinés à l'alimentation humaine. Un certain nombre d'éléments prélevés par les plantes dans le sol quittent donc cet écosystème modifié.

3. Inputs: Utility and ecological consequences:

❖ **Roles of inputs (Utility)**

To improve the efficiency of an agrosystem, man can use inputs:

• **Fertilizers** to stimulate primary productivity (proportion of mineral elements).

• **Phytosanitary** products or pesticides to fight in particular against species unwanted. We can cite insecticides, fungicides, herbicides, etc.

3. Les intrants : utilité et conséquences écologiques :

❖ **Rôles des intrants (utilité)**

Pour améliorer l'efficacité d'un agrosystème, l'homme peut utiliser des intrants :

• Les engrais pour stimuler la productivité primaire (apport d'éléments minéraux).

• Les produits phytosanitaires ou pesticides pour lutter notamment contre les espèces indésirables. On peut citer les insecticides, les fongicides, les herbicides, etc.

❖ **Ecological consequences**

-Since the 1950s, the use of inputs has exploded, which led to an increase in agricultural yields but also in the consumption of fossil fuels. Indeed, cultivating larger fields requires increased fuel consumption; in particular this accentuates the greenhouse effect phenomenon (the combustion of fossil fuels releases carbon dioxide, the main greenhouse gas).

Conséquences écologiques

– Depuis les années 1950, l'utilisation des intrants a fortement augmenté, ce qui a conduit à une hausse des rendements agricoles mais aussi de la consommation d'énergies fossiles. En effet, la culture de surfaces plus importantes nécessite une consommation accrue de carburant ; cela accentue notamment le phénomène de l'effet de serre (la combustion des énergies fossiles libère du dioxyde de carbone, principal gaz à effet de serre).

- Example: The nitrate fertilizers (providing nitrogen to growing plants): Beyond a certain quantity, the mineral nitrogen provided in the form of fertilizer is no longer used by the plants. It then remains in the form of nitrates in the soil, then, being very soluble, it will be transported by surface water runoff or by infiltration into groundwater. The nitrate content of waterways is very high, making the water of poor quality.

– Exemple: les engrais nitrés **(apportant de l'azote aux plantes en croissance): Au-delà d'une certaine quantité, l'azote minéral apporté sous forme d'engrais n'est plus utilisé par les plantes. Il reste alors dans le sol sous forme de nitrates et, étant très soluble, il est transporté par le ruissellement des eaux de surface ou par infiltration vers les nappes phréatiques. La teneur en nitrates des cours d'eau devient alors très élevée, ce qui dégrade la qualité de l'eau.**

-Indeed, in our body, these consumed nitrates are transformed into dangerous compounds capable of preventing the fixation of oxygen on the hemoglobin of our red blood cells. This excess of nitrates in the waters can also be the cause of a massive proliferation of microscopic green algae forming what is called a green tide “Eutrophication”

– En effet, dans notre organisme, les nitrates consommés sont transformés en composés dangereux capables d’empêcher la fixation de l’oxygène sur l’hémoglobine de nos globules rouges. Cet excès de nitrates dans les eaux peut également être à l’origine d’une prolifération massive d’algues vertes microscopiques, formant ce que l’on appelle une « marée verte » ou eutrophisation**.**

-Sustainable environmental management must involve reducing the several use of inputs solutions by:

- make it possible to reduce the quantity of inputs used practicing crop rotation (technique in agriculture and gardening which aims to maintain or improving soil fertility and increasing yields) allows for:
  - Fewer weeds (so there would be less need for herbicides).
  - Better biological activity of the soil (so we would need less fertilizer)
  - A limitation of pests and diseases (so we would need less insecticides and fungicides).
- Biological control: use of natural predators of pests.
- Precision agriculture: providing the necessary mineral elements very precisely, without excess.
- Limited use of inputs fits into new agricultural practices aimed at sustainably managing the environment without sacrificing returns.
- **– La gestion environnementale durable doit passer par une réduction de l’usage intensif des intrants, grâce à :**
- **¬ La rotation des cultures : cette technique, utilisée en agriculture et en jardinage, vise à maintenir ou améliorer la fertilité des sols et à augmenter les rendements. Elle permet :**
  ♣ Moins de mauvaises herbes (réduisant ainsi le besoin en herbicides)
  ♣ Une meilleure activité biologique du sol (réduisant ainsi le besoin en engrais)
  ♣ Une limitation des parasites et des maladies (réduisant ainsi le besoin en insecticides et fongicides)
- **¬ Le contrôle biologique : utilisation des prédateurs naturels des parasites.**
- **¬ L’agriculture de précision : apport des éléments minéraux nécessaires de manière très précise, sans excès.**

- **¬ La limitation de l'usage des intrants s'inscrit dans de nouvelles pratiques agricoles visant à gérer durablement l'environnement sans sacrifier les rendements.**

-Organic farming uses numerous techniques to avoid the use of any chemical inputs. There are significant disadvantages in the context of organic farming since the yield is reduced, which leads to an increase in the price for the consumer.

– L'agriculture biologique utilise de nombreuses techniques pour éviter tout recours aux intrants chimiques. Cependant, elle présente des inconvénients importants, car le rendement est réduit, ce qui entraîne une augmentation du prix pour le consommateur.

4. Animal agricultural production:

-The production of meat through livestock requires the production of plants to feed the animals. This has the consequences, of reduced energy efficiency for breeding; and higher consumption of agricultural land than for crop production. Intensive breeding is a form of industrialized breeding which aims to significantly increase the yield of this activity, in particular by increasing the density of animals on the farm (confinement).

-Meat production through intensive breeding has numerous environmental impacts:

- Significant greenhouse gas emissions (supply of food to animals, the breeding premises).
- Problems with managing animal waste.
- Livestock is damaging to the environment.
- Consuming meat or a plant product does not have the same ecological impact.
- Industrialized agricultural products cannot be considered in a sustainable manner.
-

4. La production animale :

– La production de viande par l'élevage nécessite la production de plantes destinées à nourrir les animaux. Cela entraîne une réduction de l'efficacité énergétique de l'élevage et une consommation de terres agricoles plus importante que pour la production végétale. L'élevage intensif est une forme d'élevage industrialisé visant à augmenter significativement le rendement de cette activité, notamment en augmentant la densité d'animaux dans l'exploitation (confinement).

– La production de viande par l'élevage intensif a de nombreux impacts environnementaux :

• Émissions importantes de gaz à effet de serre (alimentation des animaux, locaux d'élevage).

• Problèmes de gestion des déchets animaux.

• L'élevage est nocif pour l'environnement.

• La consommation de viande ou de produits végétaux n'a pas le même impact écologique.

• Les produits agricoles industrialisés ne peuvent pas

TD 02 : La pollution
Pollution

1. Définitions de la pollution :

- La pollution est tout ce qui altère notre environnement ou notre santé, habituellement sous forme de substances, mais aussi sous forme d'ondes.

1. Definitions of pollution:

• Pollution is anything that alters our environment or harms our health, usually in the form of substances, but also in the form of waves (radiation).

- La pollution est une dégradation ou une altération de l'environnement, en général liée à l'activité humaine par diffusion directe ou indirecte de substances chimiques, physiques ou biologiques qui sont potentiellement toxiques pour les organismes vivants ou

qui perturbent de manière plus ou moins importante le fonctionnement naturel des écosystèmes. Outre ses effets sur la santé humaine et animale, elle peut avoir pour conséquences, la migration ou l'extinction de certaines espèces qui sont incapables de s'adapter à l'évolution de leur milieu naturel.

- Pollution is the degradation or alteration of the environment, generally linked to human activity through the direct or indirect release of chemical, physical, or biological substances that are potentially toxic to living organisms or that more or less significantly disrupt the natural functioning of ecosystems.
In addition to its effects on human and animal health, pollution can lead to the migration or extinction of certain species that are unable to adapt to changes in their natural environment.

- La pollution est en général un sous-produit de l'activité humaine qui peut toucher l'atmosphère, le sol ou les eaux. Elle peut affecter la santé humaine, l'eau de consommation, l'eau de baignade, la production agricole, les espèces animales ou végétales, la beauté des paysages, etc.

• Pollution **is generally a by-product of human activity that can affect the atmosphere, soil, or water. It can impact human health, drinking water, bathing water, agricultural production, animal and plant species, the beauty of landscapes, and more.**

2. Les différentes formes de la pollution :

Les différentes formes de pollution sont :

3. The different forms of pollution:

The different forms of pollution are:

- **Pollution atmosphérique** :

Elle se manifeste par la présence dans l'air de particules ou de gaz nocifs ou non, qui entraînent, en fonction de leur concentration, un inconvénient quelconque.

La pollution atmosphérique est :

Air pollution:

It is characterized by the presence in the air of particles or gases, whether harmful or not, which, depending on their concentration, cause various adverse effects.

Air pollution is:

"L'introduction par l'homme, directement ou indirectement, dans l'atmosphère et les espaces clos, de substances ayant des conséquences préjudiciables de nature à mettre en danger la santé humaine, à nuire aux ressources biologiques et aux écosystèmes, à influer sur les changements climatiques, à détériorer les biens matériels, à provoquer des nuisances olfactives".

Exemples :

- ✓ Oxydes de carbone, de soufre et d'azote,
- ✓ Poussières,
- ✓ Particules radioactives provoquées par les rejets : des installations de chauffage, des moteurs à combustion, des installations industrielles, des incinérateurs…

- **The introduction by humans, directly or indirectly, into the atmosphere and enclosed spaces, of substances that have harmful consequences likely to endanger human health, damage biological resources and ecosystems, influence climate change, deteriorate material goods, and cause odor nuisances."**
- **Examples:**

✓ Oxides of carbon, sulfur, and nitrogen

✓ Dust

✓ Radioactive particles caused by emissions from heating installations, combustion engines, industrial facilities, incinerators, etc.

- **Pollution biologique :**

Cette pollution est due à l'introduction dans un milieu donné d'espèces exogènes (provenant d'un autre milieu, écosystème ou continent) ou d'organismes génétiquement modifiés. Elle provoque des modifications de la faune et de la flore.

Exemples :

- ✓ Espèces invasives (tortues de Floride, abeilles tueuses, fourmis du feu, l'algue Caulerpa taxifolia),
- ✓ Espèces domestiques échappées,
- ✓ Prolifération d'algues dans les plans d'eau (eutrophisation).

Biological pollution:

This type of pollution is caused by the introduction into a given environment of exogenous species (originating from another environment, ecosystem, or continent) or genetically modified organisms (GMOs). It leads to changes in fauna and flora.

Examples:

✓ **Invasive species** (Florida turtles, killer bees, fire ants, the alga *Caulerpa taxifolia*)

✓ **Escaped domestic species**

✓ **Algal proliferation in water bodies** (*eutrophication*)

- **Pollution chimique :**

Elle est provoquée par la présence dans l'environnement de substances chimiques qui normalement sont absentes ou s'y trouvent en très faible quantité.

• **Chemical pollution:**

It is caused by the presence in the environment of chemical substances that are normally absent or present only in very small amounts.

- **Pollution chronique :**

C'est une pollution permanente qui est la conséquence d'émissions répétées ou continues de polluants. Elle peut être aussi liée à la présence de polluants très rémanents (qui persistent après la disparition de la source).

Exemples : déchets radioactifs.

- **Chronic pollution**

It is a **permanent pollution** resulting from repeated or continuous emissions of pollutants. It can also be associated with the presence of **very persistent pollutants** (which remain even after the source has disappeared).

Example: radioactive waste

- **Pollution diffuse :**

C'est une pollution causée par la diffusion de multiples polluants dans le temps et dans l'espace. Peu visible, elle se distingue de la pollution accidentelle. L'indentification des pollueurs et leur responsabilisation sont rendues délicates par la multiplicité et la discrétion des origines de contamination.

Exemples : nitrates, pesticides.

Diffuse pollution:

This is pollution caused by the spread of multiple pollutants over time and space. It is often not easily visible and differs from accidental pollution. Identifying the polluters and holding them accountable is difficult due to the multiplicity and subtlety of the sources of contamination.

Examples: nitrates, pesticides

- **Pollution de l'eau :**

Elle se manifeste par une présence dans l'eau (océans, mers, lacs, fleuves, nappes phréatiques, etc.) d'éléments toxiques qui engendrent la destruction de la faune et de la flore. Elle peut rendre l'eau impropre à la consommation ou à la baignade.

Exemples :

- ✓ Effluents industriels et urbains (eaux-usées).
- ✓ Effluents agricoles : produits phytosanitaires, élevage intensif, engrais (nitrates, pesticides),

Water pollution:

It is characterized by the presence of toxic substances in water (oceans, seas, lakes, rivers, groundwater, etc.) that lead to the destruction of fauna and flora. It can make water unsafe for consumption or recreational use.

Examples:

✓ Industrial and urban effluents (wastewater)

✓ Agricultural effluents: pesticides, intensive livestock farming, fertilizers (nitrates, pesticides)

- **Pollution électromagnétique :**

Elle correspond à l'exposition excessive ou chronique d'êtres vivants ou appareils à des champs électromagnétiques soupçonnés d'affecter leur santé, leur reproduction ou leur fonctionnement. Le risque dépend essentiellement de la puissance des champs électromagnétiques, des fréquences émises et de la durée d'exposition.

Electromagnetic pollution:

It refers to the excessive or chronic exposure of living beings or devices to electromagnetic fields, which are suspected of affecting their health, reproduction, or functioning. The risk mainly depends on the strength of the electromagnetic fields, the frequencies emitted, and the duration of exposure.

- **Pollution génétique :**

On appelle "pollution génétique" l'introduction causée par l'activité humaine de gènes étrangers ou modifiés dans une espèce sauvage.

Elle s'applique également aux croisements d'une espèce sauvage avec des lignées exotiques ou domestiquées.

- **Genetic pollution:**

"**Genetic pollution" refers to the introduction, caused by human activity, of foreign or modified genes into a wild species.**

It also applies to the crossing of a wild species with exotic or domesticated strains.

- **Pollution industrielle :**

La pollution industrielle est la pollution de l'environnement par l'industrie qui affecte de manière plus ou moins importante le fonctionnement de l'écosystème :

Exemples :

- ✓ Les rejets gazeux.
- ✓ Les produits chimiques et organiques.
- ✓ La radioactivité.
- ✓ La lumière artificielle, etc.

Industrial pollution:

Industrial pollution is the contamination of the environment by industry, which can more or less significantly affect the functioning of ecosystems.

Examples:

✓ Gaseous emissions

✓ **Chemical and organic products**

✓ **Radioactivity**

✓ **Artificial light, etc.**

- **Pollution lumineuse :**

Elle est due à un excès de production lumineuse durant la nuit en milieu ouvert, la pollution lumineuse peut dégrader la perception de l'environnement et affecter les rythmes biologiques, les activités nocturnes et les migrations des animaux. Elle peut provoquer des troubles du sommeil chez les êtres humains.

La principale source de pollution lumineuse est l'éclairage public urbain.

Light pollution:

It is caused by an excessive production of light at night in open environments. Light pollution can degrade the perception of the environment and affect biological rhythms, nocturnal activities, and animal migrations. It can also cause sleep disturbances in humans.

The main source of light pollution is urban public lighting.

- **Pollution organique :**

C'est une pollution chimique causée par les polluants organiques (carbonés), qui sont des matières fermentescibles.

Exemples :

- ✓ Egouts et lisier.
- ✓ Boues d'épuration.
- ✓ Organochlorés (DDT) et polychlorobiphényles (PCB).

Organic pollution:

This is a type of chemical pollution caused by organic (carbon-based) pollutants, which are biodegradable materials.

Examples:

✓ **Sewage and manure**

✓ **Sludge from wastewater treatment**

✓ **Organochlorines (DDT) and polychlorinated biphenyls (PCBs)**

- **Pollution radioactive :**

La pollution radioactive est une contamination générée par la radioactivité.

En France, elle est définie par la norme ISO 11074-4 : elle correspond à l'Introduction, directe ou indirecte, par l'activité humaine, de substances radioactives dans l'environnement, susceptibles de contribuer ou de causer un danger pour la santé de l'homme, des détériorations aux ressources biologiques, aux écosystèmes ou aux biens matériels, une entrave à un usage légitime de l'environnement.

Elle peut être provoquée par :

- ✓ L'explosion de bombes thermonucléaires (essais militaires),
- ✓ Une épave de sous-marin nucléaire,
- ✓ Un accident grave dans des centrales nucléaires (Tchernobyl, Fukushima,..)
- ✓ Des rejets accidentels de déchets radioactifs par l'industrie nucléaire.

Radioactive pollution:

Radioactive pollution is contamination caused by radioactivity.

In France, it is defined by ISO standard 11074-4 as the direct or indirect introduction by human activity of radioactive substances into the environment, which may contribute to or cause hazards to human health, damage to biological resources, ecosystems, or material goods, and interference with the legitimate use of the environment.

It can be caused by:

✓ The explosion of thermonuclear bombs (military tests)

✓ A nuclear submarine wreck

✓ A major accident in nuclear power plants (Chernobyl, Fukushima, etc.)

✓ Accidental releases of radioactive waste by the nuclear industry

- **Pollution du sol :**

Provoquée par l'infiltration d'eau polluée, elle est souvent d'origine industrielle ou agricole : par l'utilisation d'engrais chimiques, de pesticides ...

Soil pollution:

Caused by the infiltration of polluted water, it is often of industrial or agricultural origin, for example through the use of chemical fertilizers, pesticides, etc.

- **Pollution sonore :**

On appelle pollution sonore, des nuisances sonores provoquées par les activités humaines, lorsqu'elles dépassent des seuils de nocivité pour l'acuité auditive, la santé ou l'équilibre des écosystèmes.

Exemples :

- ✓ Carrière.
- ✓ Transport (avion, train, automobile...), éoliennes.

Noise pollution:

Noise pollution refers to sound nuisances caused by human activities when they exceed harmful thresholds for hearing, health, or the balance of ecosystems.

Examples:

✓ Quarries

✓ Transportation (airplanes, trains, cars…), wind turbines

- **Pollution tellurique :**

La pollution tellurique des mers et des océans est une pollution d'origine terrestre. Elle est apportée par les cours d'eau et les canalisations qui se déversent dans la mer.

Terrestrial pollution:

Terrestrial pollution of seas and oceans is pollution originating from land. It is carried by rivers and pipelines that discharge into the sea.

- **Pollution thermique :**

La pollution thermique des eaux est l'augmentation de la température causée par des rejets d'eaux de refroidissement, en particulier des centrales thermiques et nucléaires.
Elle peut causer des dommages importants à la faune des cours d'eau.
Le réchauffement climatique provoqué par les gaz à effet de serre est une autre forme de pollution thermique qui concerne la terre toute entière.

Thermal pollution:

Thermal pollution of water refers to the increase in temperature caused by the discharge of cooling water, particularly from thermal and nuclear power plants.
It can cause significant damage to the fauna of rivers and streams.
Global warming caused by greenhouse gases is another form of thermal pollution that affects the entire Earth.

- **Pollution visuelle :**

On appelle pollution visuelle les dégradations visuelles qui portent atteinte aux paysages et au cadre de vie.

Exemples :

- ✓ Sacs plastiques transportés par le vent.
- ✓ Enseignes et panneaux publicitaires.
- ✓ Lignes à haute tension, champs d'éoliennes.

Visual pollution:

Visual pollution refers to visual degradations that negatively affect landscapes and the living environment.

Examples:

✓ Plastic bags carried by the wind

✓ Signs and billboards

✓ High-voltage power lines, wind farms

TD 03: Global warming

1. Definitions of global warming:

1-1. Simple definition of global warming:

Global warming is a global phenomenon of climate transformation, characterized by a general increase in average temperatures, and which lastingly modifies meteorological balances and ecosystems. Since the start of the Industrial Revolution, average temperatures on earth have increased more or less regularly. In 2016, the average temperature on planet Earth was approximately 1 to 1.5 degrees above the average temperatures of the pre-industrial era (before 1850).

1-2. Scientific definition of global warming:

More precisely, when we talk about global warming, we are talking about the increase in temperatures linked to industrial activity and in particular to the greenhouse effect: we therefore sometimes speak of global warming called "anthropogenic" (of human origin). It is therefore a form of global warming whose causes are not natural but economic and industrial. The best-known scientists in this field are grouped within the IPCC (International Group of Experts on Climate).

2. Greenhouse gases:

More than forty greenhouse gases have been identified by the Group, (IPCC), including: Water Vapor (H2O), Carbon Dioxide (CO2), Methane (CH4), Ozone (O3), Nitrous Oxide (N2O), Hydrofluorocarbons (HFC), Per-fluorocarbons (PFC) and Sulfur Hexafluoride (SF6).

- **Carbon dioxide (CO2):**

Represents 70% of greenhouse gas emissions from the combustion of fossil fuels (oil, coal) and biomass.

- **Nitrous oxide (N2O):**

Represents 16% of emissions from agricultural activities, biomass burning and chemicals like nitric acid.

- **Methane (CH4):**

Represents 13% of emissions from agriculture (rice fields, livestock). Part of the emissions comes from the production and distribution of gas and oil, coal mining, their combustion and landfills.

- **Ozone (O3):**

Is mainly emitted by human industrial activity. This gas contributes 6% of the total greenhouse effect

- **Fluorinated gases (HFC, PFC, SF6):**

Represent 2% of emissions used in refrigeration systems and used in insulating aerosols and foams.

- **PFCs and SF6**

Used in the semiconductor industry. Fluorinated gases have a warming power 1,300 to 24,000 times greater than that of carbon dioxide and a very long lifespan.

3. Causes of global warming:

The climate changes are due to increasing concentrations of greenhouse gases in the atmosphere. These greenhouse gases have always existed in the atmosphere naturally. But, over the past few decades, there has been an exponential increase whose origin is far from natural. The most dangerous greenhouse gases are (CO2, NH4, etc.) Human activities are today the primary cause of this increase in greenhouse effect phenomenon such as: Industries-Transportation-Agriculture-Buildings-And energy production.

4. The consequences of global warming:

In the minds of many, global warming is a relatively distant which simply implies that it will be warmer. But in fact, the consequences are much deeper:

4-1. Consequences of global warming on the ecosystem and the planet:

First, an increase in temperatures due to global warming affects the entire global ecosystem and not just the heat felt. The weather is disrupted, with an increase in extreme weather phenomena and changes to usual weather patterns. That means more storms, more floods, more cyclones and droughts. The regulatory capacity of the oceans is also affected by an increase in temperatures. If global temperatures increase very significantly, there will be an increase in ocean levels, but also an acidification and deoxygenation of ocean areas. But it can also affect areas of forests and fragile ecosystems (coral reef, Amazon forest) as well as biodiversity (corals, certain insects and even mammals may not survive).

4-2. Consequences of global warming on society and the economy:

On society and the economy, global warming can potentially have several consequences: the ability of societies to adapt to a new climate, to adapt their infrastructure, particularly medical, but also their buildings. Global warming will also have consequences for public health and food capacity of countries…

4-3. Consequences of global warming on businesses:

Finally, businesses are also likely to be affected by change and global warming. Indeed, in a context where the climate is changing, it is more difficult to adapt your activities.

5. How to fight global warming:

we must above all reduce our emissions of greenhouse gases by turning to the energies renewables and avoiding fossil fuels. But we must also reduce our energy consumption, avoid waste food, eat better by avoiding products that have too large a carbon footprint, optimize the use of natural resources…

In summary:

We must adapt our way of life to the notion of resilience and development sustainable and transform our societies to move towards an industrial model and a globalization that takes ecology into account.

6. Conclusion:

The planet's climate is likely to change quite significantly over the course of this century, largely as a result of human activities. The fallout from current civilization will undoubtedly modify the situation of individuals, regions, countries, and even continents and this on different elements of the biosphere. Moreover, the repercussions of these changes are already perceptible at the level of living things and increasing natural risks. These climate changes will bring with them many negative effects which will become more and more visible as we move forward in time. But today, why does man care so little about

climate change and its consequences? Does an extreme climatic phenomenon have to disrupt his habits to realize that the earth suffers from significant climate variations?

TD 4: Research in biotechnology

1. Definition of biotechnology:

Biotechnology is all applications of science and technology to living organisms or their components, products or models with the aim of modifying living or inert materials, for the purposes of producing knowledge, goods or services.

2. Typologies of biotechnologies:

a) First generation biotechnology:

Based on the mastery of metabolic techniques of fermentation and transformation of substrates.

b) Second generation biotechnology:

Based on the study of transmission of characters between species of the same genus.

c) Latest generation biotechnology:

Based on the manipulation of the gene and its transfer outside the species (Fluttering gene in the sky of biology which is a biosecurity problem).

3. Applications of science and technology:

Biotechnologies relying on progress in several disciplines (biochemistry, immunology, microbiology, genetics, computer science), they use components of living beings, generally after modification of their genetic characteristics, to produce developed materials. They are based on three specific properties:

- Identical propagation: ability of microorganisms, animal or plant cells to reproduce by them.
- Molecular recognition: field of study of immunology, results in the ability of living beings to recognize and eliminate all structures and molecules that are foreign to them.
- Enzymatic catalysis: Acceleration of simple or complex chemical reactions by enzymatic proteins.
-

4. The biological tools used are multiple:

They can be improved by genetic engineering, protein engineering, engineering of biological systems and networks or synthetic biology, and use:

- Microorganisms (bacteria, yeasts, fungi, etc.).
- Animal and plant cells.

- Genes and enzymes (extracted from animal and plant tissues or cultures of microorganisms)
- Antibodies (proteins capable of specifically recognizing molecules foreign to an organism).
-

5. The different areas of application:

a) The agricultural sector (green biotechnologies):

For agriculture and the environment, biotechnologies can improve the characteristics of varieties for many species. Reduce the use of fertilizers and pesticides (making plants more resistant to disease). Contribute to reducing emissions of pollutants or greenhouse gases. Better protect water resources (cultivate on polluted soils or irrigate with salt water and capture the nitrogen they need from the air).

b) The health sector (red biotechnologies):

Call for biotechnologies to discover, test and produce new treatments (vaccines, recombinant proteins, monoclonal antibodies, non-viral cell and gene therapy, viral vectors). They are used to diagnose and the causes of diseases and produce drugs for each diagnosis (diseases).

c) The field of industry (white biotechnologies):

White technologies generally use bacteria as vectors and/or producers of enzymes or other substances of technical and commercial interest (Bioindustrie) and where ecological engineering works more in situ and with ecosystems. They use fermentation techniques as the importation of organisms created by genetic engineering, or biological leaching process, or paper industry, or bioremediation (phytoremediation). They could also contribute to the development of sensors more sensitive to the physico-chemical state of the environment and its pollution by chemical substances. They could also be used to develop innovative recycling processes. Genetically modified organisms or organisms selected for their natural abilities.

d) The field of marine biodiversity (blue biotechnologies):

They aim either to develop the exploitation of still unknown resources from the marine world, or to develop and improve the management of marine species, whether farmed or wild.

e) The field of environmental protection (yellow biotechnologies):

Yellow biotechnologies use bioreactors to cultivate microorganisms capable of degrading toxic products or diluting harmful elements such as mercury, in order to make them benign.

6. Biotechnologies at the service of sustainable development:

- Create plant varieties requiring less input (fertilizers, pesticides), less water, and enriched agriculture.
- GMOs (genetically modified organisms) have already been associated with sustainable development (production of biodegradable plastic bags from starch and corn), biotechnologies today refer to energy challenges. The link between biotechnologies and agro-fuels appears here to be an alternative
-

7. The hopes of biotechnologies in terms of Health:

❖ **Prevention :**

- Appearance of new vaccines.
- Diagnostic and genetic tests.

❖ **Regenerative medicine:**

- Organ regeneration (skin of severe burn victims).

❖ **In recovery:**

- Healing of genetic (hereditary) diseases.
- New pharmaceutical products (antibiotics).

TD 5: Biology and forensics

Death by overdose or poisoning? Driving under the influence of alcohol or drugs? Drug submission during rape? Gas inhalation during fires?

1. Introduction:

Toxicologists answer these and many other questions every day. They are in fact capable of revealing small quantities of toxic substances in various environments. Blood and urine are very often analyzed, but other types of samples can be studied, such as bile or gastric contents. Likewise, hair, but also food or drinks of a suspicious nature may give rise to investigations. The products to be identified may be narcotics, medications, but also other substances of natural or synthetic origin. To carry out these identifications, the analysts of this service have, among other things, at their disposal, mass spectrometers linked to computerized databases, they also use chemical reagents using immuno-enzymatic reactions, or even carry out chromatography in liquid or gas phase (to identify crimes).

2. Scientific police seen by society:

In order to know the image of forensic science within our society, we carried out a survey on the internet. The numerous responses to this questionnaire allowed us to observe that the ideas (sometimes false) that we had before our study were common to a large part of the population. Indeed, when asked about the legal value of the results, 81% of those surveyed affirmed that they constitute evidence when, in reality, they are clues which, although essential, require perspective and discernment. To this question, only people with an activity relating to law (students in particular) made this observation. The professional field of forensic science seems to many difficult to access despite the great interest it arouses (69% of respondents would like or would have liked to work within forensic science). Finally, many people surveyed told us, in their comments, of the lack of information they had on this subject (which we ourselves observed), but also of their interest in knowing it better.

3. The biological section in the scientific police:

3.1. The role of genetic fingerprints presented through police investigations

a) What is a genetic fingerprint?

At the heart of each of the cells in our body, with the exception of red blood cells, there is a nucleus within which is found all the information of our genetic heritage in the form of DNA (Deoxyribo Nucleic Acid). For the same individual, all nucleated cells, whether contained in

blood (white blood cells), sperm, vaginal secretions, hair bulb, skin or from other tissues and organs, contain the same DNA . The identification of the same individual, by means of their genetic fingerprint, is based on the identification and comparison of specific elements included in their DNA.

b) The Dickinson affair:

In the “Mont Fort” killing trial, the main suspect was identified thanks to genetic analyzes as is the case today in many criminal cases. On July 21, 1996, Patrice Padé was accused of a heinous crime: the rape of a minor followed by murder. The tattoo, the backpack, the long hair made him the ideal culprit. Harassed with questions by the police, he breaks down and admits the crime. But fortunately, as a precautionary measure, the judge ordered a genetic expertise on the victim's body where the murderer's sperm was found. His sperm will be compared with that of Patrice Padé. Surprise, the two DNAs do not match. Patrice Padé is immediately exonerated. In a few moments this man who risked life in prison found his freedom after several days of preventive detention. Pierre Gonzalez De Gaspard, lawyer for Patrice Padai, declared: “Here is a man who thanks science every day because he would have lived last century or even before 1981, the date of the abolition of the death penalty, he was condemned to physically disappear because he would have been considered guilty” Some time later, a man was arrested in connection with another case and found to have a DNA match. Along with that of the victim, he was immediately arrested and considered the sole suspect in this murder.

c) The Figard affair:

British police have the genetic fingerprints of the man who raped and strangled Céline Figard, the young French woman who came to spend the end of year holidays in Hampshire. She was last seen on December 19, when she was getting into a semi-trailer. The body was found ten days later. The rapist's genetic fingerprints were established using traces of semen. Police sent 22,500 letters to British road transport associations describing the truck and its driver. She also decided to collect the DNA of the 4,000 drivers of white Mercedes semi-trailers, similar to the one that led Céline to her death. Police have since arrested Stuart Morgan, who has been charged with the girl's murder.

2.2. Methods, techniques and materials used during these investigations:

a) Where do these genetic clues that are so valuable to justice come from?

Every time we place our lips or fingers on even a very smooth surface, our skin flakes, meaning we lose a few cells. When we do our hair, we always leave some hair on the brush. At the root

of these, we most often find cells which contain our DNA. So, unless we take very rigorous precautions, we sow traces of our DNA in our path. It is from these traces that genetic analyzes are carried out.

b) Conditions for taking samples that may contain DNA:

During these samples, you must be very careful. To be perfectly reliable, samples must be taken under extremely precise safety conditions. Investigators must comb the crime scene. He recovers the weapon of course, but also traces of blood, cigarette butts, hair... And under a very special beam of light, they can reveal old stains of semen, saliva or urine invisible to the naked eye. Disposable overalls, plastic gloves, mask, glasses, shoes, everything is planned so that investigators leave no trace of their own DNA.

c) Techniques for analyzing samples taken.

There are two main techniques used in forensics to analyze DNA:

- RFLP (Restriction Fragment Length Polymorphism) technique:

This technique is used as a laboratory technique to differentiate or compare DNA molecules. Also this technique is used for making genetic fingerprints and in paternity tests.

- The PCR (polymerase Chain Reaction) technique:

It is an enzymatic amplification technique (Taq polymerase) which allows, from a DNA fragment, to obtain a large number (several million) of identical copies of this same fragment. This reaction is carried out in vitro (in the laboratory). It is very valuable and based on the concentration and gene amplification by polymerase chain reaction (the purpose of which is the extraction of genetic fingerprints in paternity tests).

3. Conclusion:

We have observed that genetic analyzes play an increasingly important role in criminal investigations, particularly when they help prevent miscarriages of justice. But you have to be very careful when using genetics. Indeed, genetic analyzes constitute evidence allowing one suspect to be exonerated, however they are not enough to convict another. To enable more rapid identification of individuals concerned by a police investigation, some recommend the establishment of a file containing the “genetic identity card” of each person, the latter being established from birth (to facilitate research (the work) of the scientific police).

TD 6: The functioning and management of marine and terrestrial ecosystems

1-Introduction:

Over the past fifty years, humans have changed ecosystems more rapidly and profoundly than in any comparable period in human history, largely to meet ever-increasing demands for food, fresh water, wood, fiber and energy, resulting in the dramatic and largely irreversible loss of the diversity of life on Earth.

2- Function and importance of ecosystems:

2-1 The function of the ecosystem:

Corresponds to its capacity to provide goods and services that satisfy human needs directly and indirectly (de Groot, 1992). Ecosystems assume 4 types of functions:

- **A production function**: Food (fish, mongoose, dye base substance); Energy (firewood); Genetic resources - Medical resources; Ornamental resources; Economic activities (agriculture, fishing).
- **A regulation function**: Prevention against erosion (soil fixation, sediment supply); Flood prevention (limiting wave effects); Regulation of climate and winds (CO2 sequestration, wind protection); Maintenance of biodiversity (renewal of specie and ecosystems.).
- **A support function**: Wildlife habitat (habitats, nursery areas, resting places and hiding places, etc.); Nursery function (availability of the food chain); Crustacean nutrient cycling.
- **A Cultural and amenity functions**: Recreational value and tourism (tourism, safari, panoramic and peaceful view, density, natural setting, swimming, games); Inspiration for art, cultural identity and heritage (symbolized place of worship); Spiritual and traditional information; Science and education.

2-2 Ecosystem services (or values): Correspond to the benefits that populations derive from ecosystems (Millennium Ecosystem Assessment, 2003 & 2005). Ecosystem services are valued based on their use:

- **Direct use values**: Derived directly from the use of the resource. In the case of a forest or mangrove, this may include food, fishery resources, biomass, recreation, healing

plants. For land, these values concern direct exploitable products such as crops or grazing.

- ❖ **Indirect use values**: These values come from the functional advantage of the natural resource. They are linked to the biodiversity process involving the resource in question. For certain ecosystems such as the mangrove, this involves climate regulation, soil protection and ecological interactions. But, in general, for land, indirect use values will only be effective for lands located in wetlands or those which participate in the protection of other riparian lands.
- ❖ **The option value**: These are the direct and indirect values placed on possible future uses of the resource. Apart from the values which are linked to use. These values are:

- **Heritage value:** It arises from the desire that individuals have to transmit heritage to a future generation or to their descendants (inheritance, legacy). It is this value which is important in the case of rural areas where the land of the ancestors has a value due to the very fact that it is part of the heritage which has been bequeathed to the descendants, thus forging the family unit.
- **The existence value:** Intrinsic value attributed to an environmental good, simply by knowing that it exists. Environmentalists, for example, find themselves appeased by the simple fact of maintaining certain animals considered to be rare or even by certain biodiversity processes even if they do not have a direct benefit on their existence.

3- Imbalances and disruption of ecosystems: Ecosystems are fragile groups where the fauna and flora are in balance with their biotope. Increase in human population, development of industry, urbanization, transport, overfishing and poorly diversified crops lead to the deterioration of ecosystems at different levels:

- ❖ **Disruptions coming from the environment**: Drought; Erosion; Fire; Cyclones; Storms.
- ❖ **Disorders and imbalances coming from living beings**: Deforestation; The disappearance of biotopes and living species: exterminated by hunting or by the disappearance of their natural environment; Pollution of different kinds.
- ❖ **Disturbances external to the earth**: Those elements coming from the solar system or from space: Disturbances linked to the sun: temperature rise or solar explosions; Percussion with asteroids.

4- Why create a world of ecosystem management?

The earth today is home to several billion human beings, whose numbers continue to grow. These presences of man, the technologies developed, and the economy globalization, are all restrictive elements which disturb other forms of life on earth. Man needs to understand what gives him the possibility of survival and, we hope, of living a fulfilled existence. The question posed for ecosystems management is to know how to become part of an ecological system, to understand it, to act within the limits imposed by it, by finding there at least part of what we need to guarantee our survival, while leading a decent existence.

5- Ecosystem protection strategies:

5-1 General principles: Everything must be done to contribute to its conservation and sustainable use:

- The search for paths towards sustainable economic development must necessarily involve the conservation of a viable environment.
- The future generation has the right to equally enjoy the benefits of terrestrial biodiversity.
- Greater importance must be given to ancestral practices and knowledge in terms of ecosystem conservation, and use them with the participation of the population.

5-2 The aims:

- Conserve and improve the diversity of ecosystems.
- Inform the population about the value of natural landscapes, but also encourage and gain their support for respecting different ecosystems
- Set a reasonable deadline to increase the rate of surface area allocated to protected areas.