



Course Assignment (N5)

Human Impact on the Environment



Course Assignment (N5)

- Estimated 6 hours research
- National 5 final report
 - 20% of the final grade.
 - Produced under exam conditions
 - Report is sent away to SQA

Biology assignment

This assignment is worth 20 marks out of the total of 100 marks. This is 20% of the overall marks for the Course assessment. The Course will be graded A-D.

The assignment assesses the following skills, knowledge and understanding:

- ♦ applying knowledge of biology to new situations and interpreting information
- ♦ selecting and presenting information appropriately in a variety of forms
- ♦ processing the information/data collected (using calculations and units, where appropriate)
- ♦ drawing valid conclusions and giving explanations supported by evidence/justification
- ♦ communicating findings/information

Marking

Skills, knowledge and understanding	Marks allocation
The aim of the investigation	1
Application/effect on the environment/society	2
Selection of sources of data/information	2
Selection of relevant information from sources	2
Processing and presentation of data/information	6
Drawing a valid conclusion	1
Applying knowledge and understanding of biology	3
Report structure	3

National 4

Key Area 2.3: Commercial uses of plants.

3.2: Impact of population growth and natural hazards on biodiversity: Intensive agriculture.

3.4: Fertiliser design and environmental impact of fertilisers.

National 5

Key Area Unit 3.3 Human impact on the environment

a. Increasing human population requires an increased food yield.

b. Fertilisers can leach into fresh water, causing algal blooms. This leads to a reduction in oxygen levels.

c. Pesticides sprayed onto crops can accumulate in the bodies of organisms over time. As they are passed along food chains, toxicity increases and can reach fatal levels.

d. Indicator species are species that by their presence or absence indicate environmental quality/levels of pollution.

e. Biological control and GM crops may be alternatives to mitigate the effects of intensive farming on the environment.

General Theme

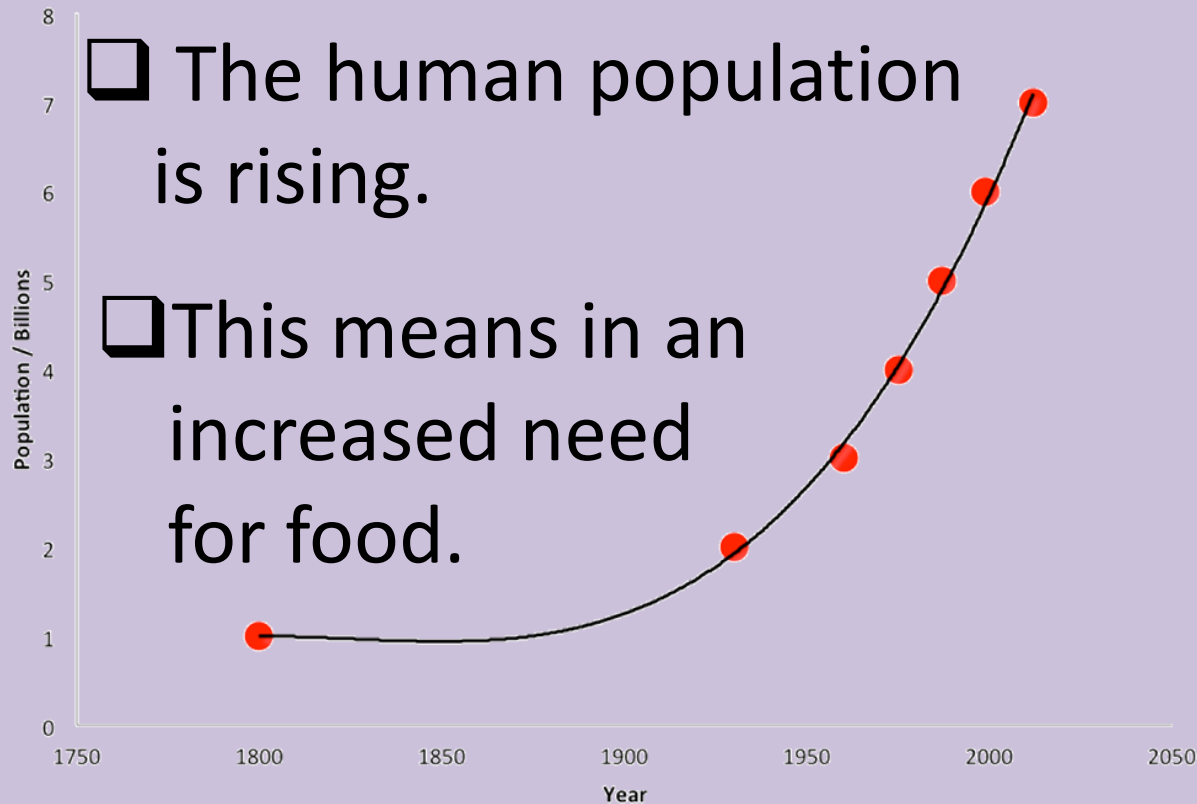
Human Impact on the Environment

- Monoculture and intensive farming
- Use of Fertilisers
- Use of Pesticides
- Biological Control

General Theme

Human Impact on the Environment

Human Population Growth



- ☐ Farming methods have changed to meet these needs.

General Theme

Human Impact on the Environment

You may wish to focus on one of the following applications:

Application	Impact
Intensive farming and monoculture N5 & N4	Effects on biodiversity, food web stability, quality, economics.
Use of fertilisers N5 & N4	Increased crop yield (quality, economics) pollution, eutrophication.
Use of pesticides N5 only	Increased crop yield (quality economics), pollution, bioaccumulation.
Biological Control N5 only	Alternatives to chemical pesticides, effects on biodiversity, food web stability.

Option 1

Monoculture



Monoculture is the cultivation of one type of crop within a large area.

Advantages	Disadvantages
Produces large yields with minimum labour	Build up of disease requiring the use of pesticides
Only requires expertise with one crop	Removal of nutrients requiring the use of expensive fertilisers
Requires only one set of specialised machinery	If the crop is lost due to disease or the weather, the farmer has no other income



Option 1

Intensive Farming

Intensive farming is obtaining high yields within a small area. It uses high input systems, including special farm buildings and high quality feeds.

Advantages	Disadvantages
High economic gains	Disease can wipe out large herds
Uses less land so more can be left for conservation	Increases stress in farm animals resulting in unwanted aggression between animals
Results in a higher food conversion efficiency in meat production	Usually uses high quality animal feeds that could be used for human consumption e.g. barley

Intensification and the dairy cow

In 1950 a British farmer needed 15 cows to make a decent living. Today a herd of 120 cows is required. In 1950, cows might produce 3000 litres of milk per year; today the average is 6000 litres, and some individuals produce over 10,000. Intensive production can compromise the welfare of animals; it can also mean fewer jobs in farming.

Intensification and the dairy cow

	Average Size of Dairy Herd (thousand head) ¹	Average Yield (litres per cow per annum) ²	Total Milk Production From Dairy Herd (million litres) ³
2001/2	2,229	6,449	14,373
2002/3	2,224	6,450	14,343
2003/4*	2,185	6,631	14,492
2004/5	2,060	6,886	14,183
2005/6	2,003	7,001	14,020
2006/7	1,989	6,963	13,852
2007/8*	1,954	6,950	13,579
2008/9	1,894	6,974	13,209
2009/10	1,853	7,056	13,073
2010/11	1,836	7,406	13,599
2011/12*	1,799	7,641	13,749
2012/13	1,795	7,361	13,215
2013/14**	1,805	7,712	13,920
2014/15	1,860	7,870	14,639



Resources

Monoculture and intensive farming

<http://www.buzzle.com/articles/advantages-and-disadvantages-of-monoculture.html>

<http://lifeofplant.blogspot.co.uk/2011/03/monoculture.html>

<https://prezi.com/r6n0vsywcg5o/the-pros-and-cons-of-monoculture/>

http://www.fao.org/fileadmin/user_upload/animalwelfare/intensive_farming_booklet.pdf

<http://www.soilassociation.org/notinmybanger/factoryfarmedpigsthefacts>

<http://www.theguardian.com/uk/2007/apr/18/foodanddrink.food>

http://www.ciwf.org.uk/includes/documents/cm_docs/2008/i/intensive_farming_booklet.pdf

Option 2

Artificial Fertilisers



Fertilisers replace the nutrients removed during harvest

Advantages	Disadvantages
Increased yield and higher profits	Too expensive for some farmers in developing countries
Artificial fertilisers are easy to manufacture and easier to spread than natural fertilisers	Can leach out into waterways and cause eutrophication

The effect of fertilisers on yields

Table 2. Effect of N and P fertilizer on 40-year average (1961 to 2000) irrigated corn and grain sorghum yields and percent yield attributable to fertilization in western Kansas.

Fertilizer applied, lb/A		Grain yield, bu/A		Yield due to fertilizer, %	
N	P ₂ O ₅	Corn	Sorghum	Corn	Sorghum
0	0	68	70	—	—
0	40	72	72	5	3
40	0	102	90	33	22
40	40	119	106	43	34
80	0	116	102	41	31
80	40	145	113	53	38
120	0	117	98	42	29
120	40	160	118	57	40
160	0	124	102	45	31
160	40	169	120	60	42
200	0	127	105	46	33
200	40	169	121	59	42

Source: Kansas Fertilizer Research, Schlegel, 1990, 1991, 2000.

Resources

Artificial Fertilisers



<http://www.environment.co.za/environmental-issues/how-do-fertilizers-affect-the-environment.html>

<http://environment.nationalgeographic.co.uk/environment/green-guide/buying-guides/fertilizer/environmental-impact/>

<http://www.pakissan.com/english/issues/impact.of.fertilizers.on.health.and.environment.shtml>

http://www.ukagriculture.com/farming_today/fertiliser_data.cfm

<http://www.agindustries.org.uk/sectors/fertiliser/uk-fertiliser-consumption-trends-and-statistics/>

http://www.potashcorp.com/annual_reports/2012/our-performance/2013-outlook/

http://www.sruc.ac.uk/downloads/file/1277/tn652_fertiliser_recommendations_for_grassland

https://www.cotswoldseeds.com/files/cotswoldseeds/Cotswold_Green_Manures_final.pdf

<http://www.twigonglow.com/films/pollution-water-1252/#tabs-2>

Option 3

Pesticides

Pesticides include herbicides (weed-killers) and insecticides.

Advantages	Disadvantages
Reduce the damage to crops	Expensive
Results in a perfect crop that is easier to market	May kill helpful insects such as butterflies and honeybees
	Maybe harmful to farm workers and consumers

Year	Region	Crop Group	Chemical Group	Total Area Treated (ha) ¹	Total Weight Applied (kg)
2014	Scotland	All Crops	All Pesticides	8,620,915	1,707,946
2013	Scotland	All Crops	All Pesticides	8,014,428	1,634,156
2012	Scotland	All Crops	All Pesticides	8,101,628	1,660,472
2011	Scotland	All Crops	All Pesticides	7,575,665	1,617,785
2010	Scotland	All Crops	All Pesticides	7,527,228	1,644,724
2009	Scotland			8,019,482	2,568,622
2008	Scotland			8,055,150	2,604,367
2007	Scotland			6,378,642	3,412,519
2006	Scotland			6,335,036	3,394,677
2005	Scotland			6,932,893	7,527,541
2004	Scotland			6,827,154	7,553,619
2003	Scotland			5,659,585	8,648,599
2002	Scotland			5,642,851	8,599,669
2001	Scotland			6,110,712	6,857,883
2000	Scotland			6,117,746	6,890,957
1999	Scotland			6,435,370	8,584,048
1998	Scotland			6,453,540	8,619,118
1997	Scotland			5,758,574	8,361,928
1996	Scotland	All Crops	All Pesticides	5,881,049	8,435,152
1995	Scotland	All Crops		5,001,854	7,524,574
1994	Scotland			4,977,788	7,504,570
1993	Scotland			5,161,168	6,167,946
1992	Scotland			4,999,262	6,135,158
1991	Scotland		All Pesticides	4,821,930	6,772,001
1990	Scotland	All Crops	All Pesticides	4,750,864	6,701,567

The Use of Pesticides in Scotland

Processing Information

<https://secure.fera.defra.gov.uk/pusstats/myresults.cfm>

Option 3

Pesticides



<http://www.epa.gov/pesticides/about/>

<http://www.pan-uk.org/agriculture/>

<http://www.marietta.edu/~biol/102/2bioma95.html>

<http://www.epa.gov/pbt/pubs/pestaction.htm#2.0>

A close-up photograph of a red and black ladybird on a green leaf. Several small, dark aphids are visible on the leaf, some near the ladybird. The background is a soft-focus green.

Option 3

Biological Control

This is using a natural predator or disease to control a pest

Advantages	Disadvantages
Avoids using chemicals	Any introduced disease can transfer to other species
Usually targets a particular species	The introduction of a species can have an effect on existing food webs
May use an existing predator e.g. Ladybird to control greenfly	May compete with native species
Same for agricultural workers	May not have predators in the new location e.g. Cane toads



Option 4

Biological Control

Lady beetles need to eat many aphids per day so that they can lay eggs. The convergent lady beetle may eat its weight in aphids every day as a larva and consume as many as 50 aphids per day as an adult. Seven spotted lady beetle adults may consume several hundred aphids per day and each larva eats 200 to 300 aphids as it grows. Once the adults and larvae have eliminated an aphid colony, they will search for additional food.

Biological control



Pest species and year of first occurrence	Typical losses in yield	Biological control agent	Start of campaign	Area under economic analysis	Reduction in loss	Estimated savings in US\$ million
Cassava mealybug 1973 (ref. 7)	40%	Encyrtid wasp <i>Anagyrus lopezi</i>	1981	27 African nations	90–95%	7,971–20,226
Cassava green mite 1971 II	35%	Phytoseiid mite <i>Typhlodromalus anipo</i>	1983	Nigeria, Ghana, Benin	80–95%	2,157
Mango mealybug 1980s (ref. 8)	90%	Encyrtid wasp <i>Gyransoidea tebygi</i>	1987	Benin	90%	531
Water hyacinth 1980 (ref. 9)	66% *	Weevil <i>Neochetina eichhorniae</i>	1991	Benin	36% †	260
Red waterfern 1978 (ref. 10)	‡	Weevil <i>Stenopelmus rufinasus</i>	1997	Republic of South Africa	§	206

* Damages of US\$84 million to fishing and trade at peak of infestation. † By 1999, full impact not yet achieved. ‡ Average damages of US\$533 per respondent (30 in total). § After three years the weed was not considered a problem anymore. II O. Coulibaly and R. Hannah, personal communication.

The data above is for a crop called cassava. It is extensively cultivated as an annual crop in tropical and subtropical regions for its edible starchy tuberous root, a major source of carbohydrates. Cassava, when dried to a powdery (or pearly) extract, is called tapioca.

http://www.nature.com/nature/journal/v432/n7019/fig_tab/432801a_T1.html

Option 3

Biological Control



<https://www.rhs.org.uk/advice/profile?PID=506>

<http://www.bbc.co.uk/learningzone/clips/growing-soft-fruit-in-scotland/8546.html>

<http://www.theguardian.com/science/grrlscientist/2012/feb/09/1>

<http://vegetable.ent.msu.edu/research/biological-control/>

http://www.nature.com/nature/journal/v432/n7019/fig_tab/432801a_T1.html



Added Value (N4)

Human Impact on the Environment



Added Value (N4)

- Topic chosen from given list
- Estimated 6 hours research
National 4 final report
 - internally marked
 - external verification

Stage 1: Research your topic

You could use a candidate's log, journal or other suitable way to record your research.

You need to choose a relevant topical issue in biology to investigate. This must relate to a key area of the National 4 Biology Course and must have an impact on the environment and/or society. Your assessor will help you to choose a suitable topic.

Now, in your candidate's log or equivalent:

- ♦ state clearly the issue to be investigated
- ♦ state briefly in what way the issue is relevant to the environment/society

Once you have chosen your issue, you need to find out about it.

Now, in your candidate's log or equivalent:

- ◆ record at least two relevant sources of information/data in such a way that they could be found by someone else — if one of your sources is an experiment/practical activity, then include the title and the aim in your information/data
- ◆ gather enough appropriate information/data from at least two relevant sources to investigate the issue

Checkpoint: Ask your assessor to check what you have done in Stage 1: the research stage of your assignment.

In your communication of findings, you must:

- ◆ Present information/data that is appropriate to your topical issue. You need to present the information/data in a suitable format, using at least one from a diagram, flow chart, table, graph, chart, key, summary or other appropriate format.

You need to present some of the information/data in your own way. This could be done by comparing or summarising information/data or by presenting information/data in a different way from that found in a published source.

- ◆ Explain at least one impact of the issue on the environment/society, using what you have found out and your knowledge of biology. The impact(s) may be positive and/or negative.

Key areas

3.2: Impact of population growth and natural hazards on biodiversity: Intensive agriculture.

3.4: Fertiliser design and environmental impact of fertilisers.

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<http://www.twigonglow.com/films/pollution-water-1252/#tabs-2>

Bibliography

This must be in a format that enables someone else to check your sources.

I recommend using <http://www.easybib.com/>

This can be used for web pages or books.

"National 4/5 Life on Earth Page 5." *Mr Mann's Biology*. N.p., n.d. Web. 08 Feb. 2016.

Torrance, James, James Fullarton, Clare Marsh, James Simms, and Caroline Stevenson. *National 5 Biology*. N.p.: n.p., n.d. Print.