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# Environmental impact of the war. Case study: Kosovo conflict of 1999

## Abstract

Technological advancements have enabled humans to transform the world and adapt it to their needs. Unfortunately, the large number of conflicts in the previous century showed that those modifications are not always to the benefit of the people. NATO intervention in Serbia in 1999 was waged to the detriment of the environment and health of local population. NATO air strikes hit industrial plants resulting in soil, water and air pollution, furthermore, their military arsenal contained Depleted Uranium (DU), a heavy metal used for military purposes that has low radioactivity levels. It is assumed that DU causes chronic diseases and contaminates nature.

**Keywords:** environment, conflict, depleted uranium, Yugoslavia, NATO intervention

## Introduction

Human race has an inalienable right to progress in a care-free environment. This depends largely on the way humans are using the resources available to them and how this impacts the environment around them. The first principle of the Declaration of Stockholm states that man has the sole responsibility to preserve the natural environment for the future generations and eliminates any action directed at inhibiting this duty (United Nations 1972). Most conflict research has focused on the loss of human life and the destruction of infrastructure however, the outcome of the war and its im-

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impact on the environment received less attention (Hupy 2008). Open armed conflicts are not the only source of environmental degradation. Indirect effects, like forced migration, pollution and trade disputes can also cause international tensions that in turn lead to severe damages to the immediate natural surroundings. Thus, it is important to dedicate a complete field of research to this area and incorporate it in the body of international law. For decades, practitioners and environmental policy makers have tried to construct an international legal framework to regulate dynamics of environment and establish clear rules on how to treat it. Treaties and regulations flowing from this work were built on many international ad hoc forums and rounds. However, there are still significant gaps. Globally speaking, leaders are aware of the threats coming from the environmental degradation, climate change and man-induced modifications on the environment.

Technology and science progressed so swiftly that humans have the power to transform the environment on an unparalleled scale. The invention, production and use of weapons of mass-destruction is one example of how man-made inventions can destroy natural habitats and cause ecological disturbances. In recent history, the most famous cases of conflicts that left visible traces of environmental degradation are the two World Wars, the Vietnam war, the Gulf war, and the Kosovo conflict.

Today it is possible to leave a permanent mark on the nature not only by the use of nuclear weapons, chemical agents or biological organisms, but also by the abuse of conventional weapons. Consequences are visible on all living species on the planet. Human population may suffer from the increased risk of lethal diseases, while animals and plants risk becoming extinct due to the modification of their natural habitat. All these effects can alter the surface of the Earth and make it less liveable.

## Overview of the conflict

On the 24<sup>th</sup> of March 1999, NATO became involved in the Kosovo war, initiating a three-month long campaign against the Former Republic of Yugoslavia (which by that time comprised only Serbia and Montenegro) and their authoritarian leader Slobodan Milošević. There were several names given to this operation but for the Serbian public it is widely known as “Operation Merciful Angel”. Governments who joined this intervention under the umbrella of NATO were: the USA, Belgium, Norway, Por-

tugal, Spain, Turkey, Canada, The Netherlands, Denmark, Italy, Germany, France and the United Kingdom (Government of Republic of Serbia 2004). The intervention had several unique characteristics. It was the first intervention to use force without the approval of the UN Security Council and the first one that aimed to halt the crimes against the humanity committed within the borders of a country.

The views on this operation are still divided to this day. On the one hand, academics, theoreticians and representatives of civilian movements saw it as justified because of the seriousness of the crimes committed against the civilians in Kosovo (Roberts 1999). On the other hand, the means that NATO employed during the intervention did not seem appropriate and did not contribute immediately to cessation of violence in Kosovo. As well as moral and ethical doubts, there were also some legal challenges that appeared problematic during and after the military operation. Namely, NATO broke several international agreements and conventions and also put into the question the validity of non-intervention principle indicated in the United Nations Charter. In addition to this, a number of environmental conventions were broken as the targets were not just military objects, but industrial complexes and civilian institutions, like schools, hospitals and a national broadcaster. A further key controversy was the use of depleted uranium (DU). The USA admitted to using it in limited amounts, but researchers and investigators found considerable amounts still residing in both Serbia and Kosovo, and believe that this had damaged the general health of the population. This will be discussed further in more details of how DU is causing division among the experts and military strategists.

A key question that has evolved concerning the intervention was why the international response came only when it did in 1999. War in Federal Socialist Republic of Yugoslavia had started in 1991 with the secession of Slovenia and it sharpened with the separation of Bosnia and Herzegovina. Some have suggested that having failed to prevent atrocities during that first phase of war, especially regarding genocidal acts in Bosnia, the international community felt obliged to act and prevent what could have become an ethnic cleansing of Kosovo Albanians (Roberts 1999). However, others suggest that had the UN Security Council at least been consulted, then the intervention would have been seen as less controversial. In addition, conduct of the war seemed to have failed to comply with general rules of warfare and resulted in violation of the Geneva Conventions and Additional Protocols, especially regarding the choosing of

targets and selection of weapons, such as cluster bombs and armoury covered with depleted uranium. It has been estimated that during the approximately ninety incidents numerous civilians were killed or injured and refugee convoys were hit (Human Rights Watch 2001).

Human loss, devastating by its nature, was not the only result of this action. NATO used high number of air strikes to deter the enemy. As a result, they targeted all infrastructure that was believed to be aiding the military of the opponent. Unfortunately, numerous civilian targets were hit causing the disproportionate damage, not only to the urban environment, but also to the natural environment. After the conflict, international agencies that were investigating the consequences identified several “hot spots” in both Serbia and Kosovo where the damage had left a visible trace (The Balkans Task Force 1999).

## Use of depleted uranium

Depleted uranium arguably altered the way the war was waged. It became one of the tools used in modern warfare and its toxicity can be lethal for the environment and individuals that come into contact with it. Its effects on the environment have been studied extensively by different governmental institutions and NGOs and despite its negative effect, it would be possible to mitigate it with effective tools. However, this will require strong leadership, legal frameworks and sufficient funding dedicated to the environment and its preservation.

But what exactly is DU? DU represents a toxic substance with small radioactivity levels. This heavy metal is composed mainly of three uranium radioactive isotopes (*Table 1*) –  $^{234}\text{U}$ ,  $^{235}\text{U}$  and  $^{238}\text{U}$  (Đurić–Popović 2012). It is a result of the enrichment process of natural uranium. During this process, the radioactivity levels decrease for about 40% (WHO 2001). Scientists estimate that while this by-product of uranium is recognized as a poisonous metal, its radiation is quite low (WHO 2001). The first production of DU dates back to the beginnings of WWII in the United States, at the same time when nuclear programs were conceived. After that it has been used in different conflicts and there was a significant increase in its presence in militaries from the 1980s onwards. The most notable cases are the Gulf war and the Kosovo conflict that led to an array of research on the side-effects of DU being carried out.

**Table 1.** *Natural uranium isotopes*

Isotopes	Relative Abundance by Weight	Half Life (Years)	Specific Activity (Bq mg <sup>-1</sup> )
238U	99.28%	4 510 000 000	12.4
235U	0.72%	710 000 000	80
234U	0.0057%	247 000	231 000

*Source: IAEA (2017)*

Although this metal is known for its use in warfare, there are numerous ways in which DU can be used in peaceful times as well. It can be used in hospitals to shield the medical equipment used for radiation (e. g. X-rays) or as counterweights in planes and missiles (Craft et al. 2004). On the other hand, its military usage has been adopted because of the metal's characteristics. DU is an extremely dense metal, thus armours, bullet shells and missiles are tipped with it. Non-DU munition cannot defend itself against these arms. It was found that DU weaponry can penetrate even bunkers, aside from other conventional weapons thanks to its kinetic energy. The main characteristic when used in military purposes is its pyrophoric nature. This means that on impact it does not produce any explosion, but rather turns into small particles, of size between 0,5–5 microns, that can be inhaled if in the immediate surrounding areas. Only part of that is soluble, hence it can stay in lungs over longer period and cause respiratory problems (Mishima et al. 1985). Some part of insoluble particles the body naturally excretes in few days, but this largely depends on the composition and toxicity level of the inhaled material. Some of the notable diseases linked with DU are kidney failure and lung cancer. Research has shown that it is highly unlikely that it would result in causing leukaemia (Foley 2001). Experts also say that DU poses low risks if it is outside of the organism and normally does not penetrate through skin cells (Đurić–Popović 2012). These claims are still in the centre of ongoing debates and there are research centres that have published works on the negative effects of DU and pointed out the importance of not underestimating the chemical composition and toxicity of this metal (International Action Center 1999). Considering its environmental impact, aerosol particles can stay in the air over long time and can easily be moved to other parts of the territory by wind streams. DU contained in water depends on its solubility, while once

it is stored in soil it stays there and it does not extinguish until it is physically removed (U.S. Army Chemical School, 1995). It might be important to note that natural uranium is generally present in nature and small amounts of it are not posing any threat to animals nor people.

DU only attracted the attention of the global community after its extensive use in the Gulf war. Estimations collected from different resources and direct research data collected on the spot are that around 320 tons of DU were fired during that war (Bertell 1999). Many are now linking the usage of it to the “Gulf war syndrome”. Thousands of Veterans have reported a series of chronic diseases after coming back from the Gulf bay. Nevertheless, the IAEA conducted research on the effects of DU on humans and the environment and concluded that whilst DU is potentially toxic and that exposure to it could cause long-term damaging effects on health, there is no conclusive link between cancers and DU (IAEA 2017).

## Military action – effects and results

The NATO intervention lasted in total for 78 days in the spring of 1999. Most of the combat was through aerial attacks, but some land attacks took place as well. During the 78 day period, there were more than 25,000 flights over the territory of former Yugoslavia and more than 17,000 attacks were executed (REC 1999). The goal was to stop the atrocities and deter the Serbian army from engaging in combats in Kosovo. While on the paper the actions of NATO seemed legitimate, the reality told a different story. The intervention methods were questionable and their effects raised alarm across the globe. Images of toxic materials being released into the water and soil and thick clouds above oil refineries that were hit in Belgrade and Pančevo were devastating. While they were justified through the principle of proportionality and military necessity, it was clear that the “humanitarian” character of the intervention was not a priority. Other than visible immediate consequences for the population, the wider audience was concerned with the possible long-term environmental damage that could be felt in the region as well. NATO, however, claimed that it used highly sophisticated weapons and chose only targets that were evaluated as critical in assisting Serbian military (The Balkans Task Force 1999).

International investigation teams that evaluated the impact of the bombing concluded that there was no significant contamination of the general soil, but they did find several concentrated “hot spots” with a higher degree of DU on the territory of Serbia, Kosovo and Montenegro (UNEP 2002). The effects are visible in soil, water and air and it also had an impact on biodiversity in Serbia. The most important results will be briefly presented here.

One of the major contamination areas was the city of Pančevo, which is approximately 15km from Belgrade. The city is host to the industrial complex composed of an Oil refinery (NIS Oil Refinery), a Petrochemical plant (HIP Petrohemija) and a Factory that is producing nitrogen fertilizers (HIP Azotara). It is needless to say that any damage can cause leakage of hazardous material on an unprecedented scale. It is worth mentioning that civilians live close to the industrial part of the city and they had to be evacuated during the conflict. Aerial attacks hit this industrial complex and a series of substances (*Table 2*) such as mercury, ammonia, vinyl chloride monomer (VCM) and 1,2-dichlorethane ended up in the soil and underground waters contaminating eventually the Danube river (REC 1999). All of these are lethal for the terrestrial and aquatic environment and can also affect humans by causing birth defects, genetic mutations and are seen as carcinogenic. The Danube river, on which Pančevo lies, was immediately contaminated and while there were efforts to prevent the spread of the toxic materials, it is not clear how effective the response was (REC 1999). There were also findings of a high concentration of 1,2-dichlorethane in drinking water that significantly exceeded normal levels of 5µg per litre (Robson 2002). Similar destiny had the oil refinery in Novi Sad, capital of the autonomous region of Vojvodina, which leaked petroleum products in the Danube (REC 1999). Another issue is the release of pollutants caused by the explosions, like hydrochloric acid fumes, nitrogen and sulphur compounds (Robson 2002). All these chemicals may cause acid rains in the future and further endanger the biodiversity in the area.

Kragujevac, a city in central Serbia, with a population of about 150,000 people was also attacked several times by NATO forces. This city is generally famous for the car factory “Zastava”. It is one of the main sources of income for many locals and aside from cars it also produces heating for one part of the city (UNEP 2002). The factory was hit several times and most of the infrastructure was destroyed (i.e. the assembly line, power station, paint stationary), while the production was stopped (Robson 2002). The strikes

ended up causing pollutants from the factory, namely transformer oil – polychlorinated biphenyls (PCB), to reach the soil and water (The Balkans Task Force 1999). PCB has carcinogenic characteristics and can be lethal for humans. Under the auspices of UNEP, The Balkan Task Force (1999) could confirm, after thorough examinations, that this factory is one of the post-conflict environmental concerns because of the levels of dioxins and PCB contained in the soil and water where the factory was hit.

**Table 2.** Summary of pollutants released in Pančevo during the bombing of 1999

Substance	Location	Amount released (metric tons)	Emission route
Ammonia	HIP Azotara	250	Waste channel
Calcium ammonium nitrate, phosphates, potassium chloride	HIP Azotara	250	Most burned, some into channel
Crude oil	HIP Azotara	150	Most burned, some into channel
Vinyl chloride	HIP Petrohemija	460	Burned
1,2-dichloroethane	HIP Petrohemija	2 100	50% to channel, 50% to soil
Mercury	HIP Petrohemija	8	7.8 metric tons to soil, rest to water
Sodium hydroxyde	HIP Petrohemija	100	Soil and waste channel
Ethyl-, propylene	HIP Petrohemija	1 900	Intentionally burned
Hydrochloric acid	HIP Petrohemija	130	Soil and waste channel
Crude oil and derivatives	NIS Oil refinery	85 000	80 000 metric tons burned, rest spilled onto soil

*Source:* The Balkan Task Force(1999); Gopal, S. – Deller, N. (2002)

The city of Bor, near the border with Bulgaria, contains a copper mine and an important oil depot. During the intervention, the mine was struck and damaged. This potentially could have released sulphur dioxide gas. The effects of this might spread to the neighbouring country depending on the wind streams. Hence, the plausible environmental problem becomes transnational.

All this identified damage was a consequence of using conventional weapons and by choosing strategic targets in order to disable the enemy. Aside from these, hundreds of



smart bombs and missiles tipped with DU were launched. As mentioned beforehand, DU at the time of the hit turns into tiny dust particles and can be easily moved through air exposing to danger anyone who is close to the targeted area. UNEP (2002) found the presence of DU in all areas they identified as contaminated, but they claim that the radioactivity levels in air, water and soil are quite low and that they do not pose health or significant environmental threats. Hence, according to the research, bullets and armours tipped with DU used in NATO bombing in 1999 did not leave any significant traceable effect. Despite these results, different research showed that there has been a notable increase in the number of people with cancer since 1999 (Rowland 2001). Starting from this year, Serbian government plans to conduct research that would possibly reveal the long-term effects of the NATO bombing as previously no such efforts were made.

## Conclusion

The NATO operation Allied Force, though humanitarian in nature, was an extremely controversial move that went against international law and breached treaties regulating warfare. The strategic targeting of chemical and oil plants proved to be disastrous for the local population and the environment. The effects can still be seen in the cities that are industrial centres, especially regarding air pollution, and the contamination of drinking water and soil. The massive use of DU, despite showing low radioactivity levels shortly after the conflict, might still be present in Serbia and given the potential for a high level of malignant diseases, more conclusive researches should be conducted.

As for now, the Republic of Serbia has a long way to go in outlining and implementing plans that would work on ecological recovery and re-establishment of natural harmony. There is also a need to raise awareness on ecological needs of the country and reinforce institutional networks that would deal with issues concerning environment and challenges that come with it. These are all crucial in the development of human society because the environment is a common good that needs to be preserved in both times of peace and war.

## References

- Bertell, R. (1999): *Gulf War Veterans and Depleted Uranium*. Hague: Hague Peace Conference.
- Craft, E. S. – Abu-Qare, A. W. – Flaherty, M. M. – Garofolo, M. C. – Rincavage, H. L. – Abou-Donia, M. B. (2004): Depleted and natural uranium: Chemistry and toxicological effects. *Journal of Toxicology and Environmental Health*, 7(4), 297–317. <https://doi.org/10.1080/10937400490452714>.
- Đurić, G. – Popović, D. (2012): Procena Štete u Životnoj Sredini zbog upotrebe Municije sa Osiromašenim Uranijumom («Damage estimation of the environment as a consequence of the usage of DU munition»). In V. Pavlović (ed.): *Ekologija i Rat – Izveštaj nezavisnih eksperata o NATO bombradovanju SRJ* [Ecology and War – Independent experts report on the NATO bombing of Yugoslavia], 115–129. Belgrade: Službeni Glasnik.
- Foley, K. P. (2001, January 18): Health report: NATO says depleted uranium weapons do not cause cancer, IFC invests in Russian health care. Retrieved October 30, 2018, from <https://www.rferl.org/a/1095546.html>.
- Gopal, S. – Deller, N. (2002): *Precision Bombing, Widespread Harm Two Case Studies of the Bombings of Industrial Facilities at Pancevo and Kragujevac During Operation Allied Force, Yugoslavia 1999*. Maryland: Institute for Energy and Environmental Research.
- Government of Republic of Serbia (2004): *Hronologija zločina i beščašća NATO* [Chronology of crimes and NATO's dishonor]. Retrieved March 29, 2018, from <http://www.arhiva.srbija.gov.rs/vesti/1999-06/05/13088.html>.
- Human Rights Watch (2001): *Under Orders: War Crimes in Kosovo*. New York: Human Rights Watch.
- Hupy, J. P. (2008): The environmental footprint of war. *Environment and History*, 14(3), 405–421. <https://doi.org/10.3197/096734008x333581>.
- IAEA. (2017): Depleted uranium. Retrieved October 29, 2018, from <https://www.iaea.org/topics/spent-fuel-management/depleted-uranium>.
- International Action Center (1999): *NATO bombing unleashes environmental catastrophe in Europe*. New York: International Action Center.

- Mishima, J. – Parkhurst, M. – Scherpelz, R. – Hadlock, D. (1985): Potential behavior of depleted uranium penetrators under shipping and bulk storage accident conditions. Richland: Pacific Northwest Labs. <https://doi.org/10.2172/6027732>.
- REC (1999): Assessment of the environmental impact of military activities during the Yugoslavia conflict. The Regional Environmental Center for Central and Eastern Europe.
- Roberts, A. (1999): NATO's "Humanitarian war" over Kosovo. *Survival*, 41(3), 102–123. <https://doi.org/10.1080/00396339912331342943>.
- Robson, T. (December 10, 2002): Long-term environmental damage due to NATO bombing in Yugoslavia. Retrieved October 28, 2018, from <https://www.wsws.org/en/articles/2002/12/yugo-d10.html>.
- Rowland, J. (2001, January 15): Uranium tests for Serbs. Retrieved October 30, 2018, from BBC: <http://news.bbc.co.uk/2/hi/europe/1119197.stm>.
- The Balkans Task Force (1999): The Kosovo conflict: Consequences for the environment and human settlements. Geneva: UNEP/UNCHS.
- U.S. Army Chemical School (1995): Development of Depleted Uranium Training Support Packages: Tier I – General Audience. U.S. Army Chemical School.
- UNEP (2002): Depleted uranium in Serbia/Montenegro: Post-conflict environmental assessment. Geneva: UNEP.
- United Nations (1972, June): United Nations Conference on Human Environment. New York: UN. Retrieved October 07, 2018, from <http://www.un-documents.net/unchedec.htm>.
- WHO (2001): Report of the World Health Organization: Depleted uranium mission in Kosovo. Copenhagen: WHO – Regional Office for Europe.