Chapter Four

Paradise Lost: The Anthropocene

Introduction

In the present geological era, humans have become the root cause of every environmental change, causing global species extinction, climate shifts, and reshaping the terrestrial biosphere. Atmospheric chemist Paul Crutzen and ecologist Eugene Stoermer (2000) have termed this epoch, Anthropocene. Unlike the previous geological epochs, it is an era marked with climatological and physical disruptions of the earth's environment: "Earth is now a human planet. We decide whether a forest stands or is razed, whether pandas survive or go extinct, how and where a river flows, even the temperature of the atmosphere. We are now the most numerous big animals on Earth…It is an extraordinary time" (Gaia Vince 5). The word "Anthropocene" has its origin in ancient Greek. "Anthropos" means 'human' and the suffix "-cene", from *kainós*, meaning 'new'. All epochs of the current geological era, the Cenozoic, end with the suffix "-cene". The current Holocene epoch began almost 12,000 years ago, and the scientists designate the current inter-glacial, warm period as Holocene. Crutzen explains in his article "Geology of Mankind" (2002) in *Nature* that,

> It seems appropriate to assign the term "Anthropocene" to the present, in many ways human-dominated, geological epoch, supplementing the Holocene—the warm period of the past 10-12 millennia. The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing

> global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt's design of the steam engine in 1784 (Crutzen 23).

Quoting Crutzen, Mark Whitehead in *Environmental Transformations: A Geography of the Anthropocene* (2014), states that Anthropocene is marked by 'greenhouse gases' reaching their highest levels for 400,000 years. With humans regulating the flow of water by building dams, global industries releasing 160 million tonnes of sulfur dioxide in earth's atmosphere, fisheries industry exploiting the ocean, application of artificial and toxic fertilizer to the soil, and extraction minerals from earth's crust through mining (Whitehead 1), humankind has become 'the pervasive force' behind pushing the 'earth as a whole into planetary *terra incognita*' (Clark 1). In his seminal work "The Climate History: Four Theses" (2009) the historian Dipesh Chakraborty, while citing the concept the Anthropocene argues about the irreversible impact of climate change on human history. The impacts of the Anthropocene have taken few trends, such as global climate disruption, species extinction, loss of ecosystems, pollution and toxicity of land, air, and water, and unprecedented growth of the human population. These are the pressing concerns, well-substantiated by scientific observations and data, accelerating since the industrial revolution. "Anthropocene", as environmental philosopher Dale Jamieson explores, "presents novel challenges for living a meaningful life" (Jamieson 185). Anthropocene poses various environmental questions and urges to reflect on the broad range of human and nature interactions. It describes the conflicted relationship between humans and nature: "Insofar as the Anthropocene describes the degree in which human beings have colonized nature, it

does not deny that such colonization may have taken place in different ways in different places and continues to do so" (Manuel Arias-Maldonado 7).

This chapter presents an analysis of Kingsolver's fiction and non-fiction, representing the awareness of largescale environmental changes because of the Anthropocene (particularly climate change, species extinction, and growing toxicity). The chapter is divided into three sections: species extinction, increasing climate disruption, and growing toxicity of the ecosphere. Each section studies these themes in Kingsolver's fiction and non-fiction. Kingsolver's writings of the Anthropocene emerge from an awareness that there is no scope of separation and distinction among the human and nonhuman species because of the anthropogenic impact on the environment. Her works express her concerns over the present eco-crises that have put a question on the planetary survival and the survival of all species. There is a dystopian tendency reflected in her work that makes her Anthropocenic writings a *narrative of confrontation* (emphasis is mine) with an earth that is pushed to become *terra incognita* (Clark 1). In these narratives, she focuses on the human-nonhuman encounter and the effect of human aggression towards nonhuman. The human-modified environment and anthropogenic actions gradually diminish the scope of human-nonhuman cohabitation. Kingsolver focuses on these activities that humans are engaged in, leading to alterations in the species lives and the ecosphere. She poses a question on the earth's future where Anthropocene is affecting all ecological processes. Based on her knowledge of environmental science and biology, these writings of Kingsolver foreground a functional understanding of the role of humans in the complex and shifting dynamics of the whole ecosphere. This chapter also presents the texts as narratives of confrontation, between human

and nonhuman species in the ecosphere, with the hope of ushering a change towards the sustainability of the planet.

Anthropocene: Species Extinction

> As we encroach on nature and deplete vital habitats, increasing numbers of species are at risk. That includes humanity and the future we want.
>
> António Guterres, UN Secretary-General

Extinction refers to the loss of species, and the loss is irreversible. The reasons may vary from global climate change, habitat fragmentation, natural disaster, and overexploitation of species for human use. The rate of extinction varies widely. Ecologists estimate that the current extinction rate is 1000 to 10000 times more than the extinction rates of previous epochs because of overhunting, overharvesting, pollution, climate change, human activities, etc. This high extinction rate is primarily due to human-induced extinctions, which are 1000 times greater than past natural rates of extinction. This is leading some scientists to call modern times the Sixth Mass Extinctions. The result will be a massive loss of between 30 and 50 percent of extant species by the middle of the 21st century (britannica.com/ explore/ saving earth/ extinction). Humans are the greatest threat to other species, and we are aware of this fact. Ledec and Goodland (1998) state that humans are aware of the implications of their actions and are capable of controlling them (9). Rose, Dooren, Chrulew, and Wolfe in *Extinction Studies* (2017) have reflected that: "This mass death event differs from the previous five in one fundamental way: it is being driven almost entirely by humans […] We eat animals, log their forests for housing, cull

their numbers for convenience, destroy and transform their homes and lives through unyielding systems of development and security" (2).

The present crisis of species extinction brings in the evident debate on speciesism, a concept coined by Richard Ryder in 1975. He explores that speciesism refers to a "prejudice or biased attitude favouring the interests of the members of one's own species against those of members of other species" (Ryder 138). Philosophers have long observed the contrariety in the systematic consideration of human-animal relationships that can be called "speciesist". Speciesism, in the philosophical literature, refers to the assignment of different inherent moral status based solely on an individual's species membership. Speciesism manifests itself in the belief system that humans are intrinsically more valuable than other species and that this unequal treatment is morally justifiable (Cavoila et al. 2). Speciesism, like sexism and racism, is found existent in every culture and society but is manifested in different forms. The debate on "morally justifiable" argues for bringing in reference to the ground-breaking work of Peter Singer, *Animal Liberation*, published in 1975. Here, Singer has argued for the equal consideration of the interests of species, other than human, appealing to ethics: "the ethical principle on which human equality rests requires us to extend equal consideration to animals too." Singer explains that ethical principles are the fundamental elements of moral philosophy and according to the principle of equality it must be extended to all beings, "black or white, masculine or feminine, human or nonhuman" (Singer 1-5). Greg Garrard observes in Ecocriticism (2004) that Singer draws upon arguments put forward by Utilitarian philosopher Jeremy Bentham (1748–1832), who suggested that "cruelty to animals was analogous to slavery and claimed that the capacity to feel pain, not the power of

reason, entitled a being to moral consideration. Singer gives the label 'speciesism' to the irrational prejudice that Bentham identifies as the basis of our different treatment of animals and humans" (Garrard 136). Garrard explains that Singer contends that the suffering of humans doesn't count more than the suffering of an animal. This argument is derived from the Utilitarian tradition in ethics that holds that actions are not right or wrong in themselves, but only that they bring happiness or cause pain. Ursula Heise (2016) discusses the advocacy of animal rights in the context of speciesism, as explained by Singer (1975) and Ryder (1970). She states that the legal right framework is not universally accepted by animal welfare advocates committed to individual animal well-being. She argues that environmentalist thought is more holistic in comparison, as it aims to preserve the whole complex ecosystem. Thus, it may be argued that Heise converges these philosophical orientations while explaining the Anthropocenic species extinction and habitat or ecosystem mutilation in a more holistic way.

Kingsolver addresses these philosophical orientations while documenting the discriminations in human-nonhuman relationships as a biologist and environmentalist. She describes the current extinction crises and fate of vanishing endangered species in her fiction and non-fiction. It foregrounds the possibility of the beginning of the Sixth Mass Extinction. Her works can serve as "cautionary tales" that Heise has emphasised so much in *Imagining Extinction* (2016). But the concern remains: what affirmative visions of the future all these cautionary tales can offer. Kingsolver poses the question: what are the new paradigms that all these cautionary tales conceptualize that enumerate the relationship between human and nonhuman species. Heise (2016) raises the inevitable questions such as why species

go extinct, how we know what endangers them and why we care about some endangered species and not others, and what means we choose to express our concern" (Heise 13). Kingsolver's anthropocenically aware environmental writings on species extinction attempt to respond to these questions.

Prodigal Summer **(2000)**

Prodigal Summer (2000) has three apparently separate but interwoven narrative strands, Predators, The Moth love, and Old Chestnuts. The strands narrate intertwined stories of people, animals, and plants, "the ranger who tends the mountain and the hunter who invades it; a chestnut breeder and an apple farmer, aging neighbours who quarrel about propriety and pesticides; and an entomologist struggling to adjust to life as a farmer's widow" (Leder 232).

In "Predators" of *Prodigal Summer,* Deanna Wolfe, a reclusive wildlife ecologist, and forest ranger, discovers the coyote family that has moved into the ecological niche left by the now-extinct red wolf. The red wolf was the keystone predator in the forest range of Zebulon County in southern Appalachia. Deanna, while expressing her anxiety for the necessity of the survival of the coyote family, voices Kingsolver's own concern for maintaining an ecological balance in this bioregion: "She believed coyotes were succeeding here for a single reason: they were sliding quietly into the niche vacated two hundred years ago by the red wolf. The two predators were hardly distinct: the red wolf may have been a genetic cross between the grey wolf and the coyote" (Kingsolver 63). Kingsolver, through her character Deanna, describes how the coyote is considered the most hated species in

America. The U.S. Government is involved in the business of exterminating them using cyanide traps and gunning from helicopters. Mary Louisa Cappelli (2017), in her article "Predator Politics: Coyote Wrenching in Edward Abbey's Desert Solitaire and Barbara Kingsolver's Prodigal Summer", has pointed out this reality. Cappelli studies that the coyote has been an integral predator of North America for more than hundreds of years. The coyote populations fluctuate depending on the politics of the geographical bioregion in which they live. Coyotes have been slaughtered by the U.S. Department of Agriculture (USDA) Wildlife Services. They are regularly killed in predator killing contests or displaced by land enclosures, urbanization, and environmental degradation (1).

Thus, the coyote is not a predator but also prey. Before humans, wolves were the main predators of coyotes. In the novel, this coyote family migrates from the deserts of Mexico and the Southwest to the Appalachian high mountains and forests. They get a survival threat as Eddie Bondo arrives. Eddie is a Wyoming sheep rancher and hunter who wants to kill the coyotes. Eddie works for the *Mountain Empire Bounty Hunters,* and he manages to hide his intention of the extermination of the coyotes from Deanna in the beginning. These bounty hunters are part of various predator killing contests and among the major reasons for top-level predator extinctions. However, he eventually fails to gain Deanna's trust in the process. Deanna resonates with Kingsolver's concern that Anthropocenic imbalance in the ecosystem is a significant cause for all environmental problems, including mass species extinction. The earth as an integrated system cannot exist outside of a symbiotic relational field. Eddie's crusade against the coyote family acts as a testimony of such imbalance. Deanna refers to zoologist Robert T. Paine while

explaining the significance of a keystone predator in an ecosystem to Eddie. Paine, in his famous experiments in the 1960s, formulated the keystone species concept and the negative ecological impact of exterminating a single key predator from its ecosystem. It hampers the whole biological pyramid. This view resonates with Aldo Leopold's view that wolf extermination harms the mountain, and eradication of wolves harms an ecosystem and the biotic pyramid. Peter S. Wenz (2003), in his article "Leopold's Novel: The Land Ethic in Barbara Kingsolver's Prodigal Summer", refers to Aldo Leopold's words in "Thinking Like a Mountain". Wenz brings in Leopold's concept of the biotic pyramid and elaborates that "Killing carnivores removes predators of species, such as deer, that tend to overpopulate and harm ecosystems by overeating the plant layer near the base of the pyramid. Thus, Leopold does not object to hunting *per se*, but he does object to hunting major predators" (Wenz 109). Edward Abbey in *Desert Solitaire* (1990) has also advocated one of his most substantial environmental premises supporting predator conservation and protection: "We need more predators. We need more coyotes, more mountain lions, more wolves and foxes and wildcats, more owls, hawks and eagles" (31). Abbey vividly describes the human predation of top carnivores. The top carnivores are prey to the most ingenious device of chemical and biological warfare, such as shooting coyotes from airplanes, hunted by bounty hunters, government agents planting poisoned meat and hiding cyanide guns in the ground, and using a biochemical compound that makes any animal sterile (38).

In "Predators", Deanna reflects that humans are merely witnessing and recording the elimination of a predator from a system and the dire consequences of "richness to one extinction after another" (Kingsolver 63) in the whole planetary

ecosphere. She believes that the coyotes as the keystone predators are significant in an ecosystem: "The life of a top carnivore is the most expensive item in the pyramid, that's the thing" (Kingsolver 267). They are non-native species in the ecological system of the Zebulon forest. Deanna makes it clear in her argument, which favours the coyotes, explicitly stating her stand on the coyotes as a non-invasive species, "maybe coyotes would turn out to be pests, as newly introduced species nearly always are" (Kingsolver 63). But she could perceive that the coyotes are the ghosts of a creature long extinct, coming back in silent footprints. This is a magical juncture, a restoration caused by nature, in the complex anatomy of this forest.

The title "Old Chestnuts" refers to the near extinction of American chestnut trees due to a blight in the early 1900s in the Appalachian ecoregion. "Old Chestnuts" portrays the complex relationship between retired agriculture teacher Garnett Walker and his organic apple grower neighbour, Nannie Rawley. Garnett Walker is attempting to cross-breed the American chestnut with the blight-resistant Chinese chestnut. In this section of the novel, Kingsolver has referred to one of the greatest plant species extinction in America and various issues related to American environmental dialogues. Kingsolver, through Nannie Rawley's letter, brings the bitter truth about the fall of the majestic chestnuts because of exotic fungal pests:

> Who cares if one species is lost?" The extinction of one kind of tree wreaked pure havoc on the folks all through these mountains…It would take [you] a day and a night to try and explain why the chestnut was a tree unlike any other, that held a purpose in our world that nothing else can replace…[if]someone had shown you a little old seedling tree potted in a handful of dirt coming in on a ship from Asia all those years ago, asked you

> to peek into it, and remarked, "These piddly little strands of fungus will knock down a million majestic chestnut trees…To our dominion over the earth [Mr. Walker] we owe our thanks for the chestnut blight. (Kingsolver 215-216).

In this context, it is essential to mention the scientific studies explaining the extinction of American chestnuts. Scott E. Schlarbaum, Frederick Hebard, Pauline C. Spaine, and Joseph C. Kamalay (1998), in their research work "Three American Tragedies: Chestnut Blight, Butternut Canker, and Dutch Elm Disease", point out that three prominent North American tree species, American chestnut, butternut, and American elm have been severely impacted by three exotic fungal diseases, chestnut blight, butternut canker, and Dutch elm disease. The American chestnut, the dominant hardwood species in the eastern United States, was utilized variously by early European settlers, such as food and timber and tannin. The American chestnut was found in vast stands from Maine to Florida, with the largest trees occurring in the southern Appalachians. However, during the 19th century, the advent of fungal diseases changed the species composition of eastern North American forests. This fungal disease was followed by the more commonly known chestnut blight. By the 1950s, virtually all mature American chestnuts had succumbed to the disease (1-2).

Kingsolver, in her essay **"Knowing Our Place"**, in the essay collection *Small Wonder* (2003), has described the majestic chestnuts and their fall. Some pragmatic homesteaders perceived this extinction as something "godsend" to build their home with the fallen logs. Kingsolver had a log cabin made of chestnut logs in the Walker mountain in the late 1930s, "when the American chestnut blight ran

roughshod through every forest from Maine to Alabama, felling mammoth trees more extravagantly than the crosscut saw". This is one of the great natural tragedies in the continent's history to those who never have the chance to witness the spreading crown of the American chestnut.

***Flight Behaviour* (2012)**

Kingsolver's climate change fiction *Flight Behaviour* (2012) is centred on the life-altering experience of a woman, Dellarobia Turnbow, the frustrated, placid housewife from a small town in southern Appalachia. Her momentary romantic escapade makes her face the unfamiliar territory of planetary transformation in the form of a huge Monarch butterfly migration. Kingsolver deliberately includes various viewpoints (religious, scientific, political, etc.) about the migration of Monarchs or King Billies, as the locals call them. Dellarobia's exchanges with the scientist Ovid Byron connect her with the environmental crises of species extinction in a different way. Earlier after her initial encounter with the monarchs, religious explanation or the "God's grace" theory is predominant in her belief. She is devastated by the havoc that happened both in Mexico and Tennessee with the Monarchs. She tries to assimilate this anthropogenic species extinction scenario. Now, she can perceive the current massive change in the planetary ecosystem:

> We are seeing a bizarre alteration of a previously stable pattern," he said finally. "A continental ecosystem breaking down. Most likely, this is due to climate change. Really I can tell you I'm sure of that. Climate change has disrupted this system. For the scientific record, we want to get to the bottom of that as best we can, before events of this winter destroy a beautiful

species and the chain of evidence we might use for tracking its demise. It's not a happy scenario (Kingsolver 125-126).

Kingsolver represents the precise scientific truths in her fictional portrayal of the extinction risk of various species. Anthropocene resulting from human action leads to critical consequences that include shifts in climatic conditions and ecosphere, a reversal in competitive relationships among the human and nonhuman species, habitat loss, and altered migrational capabilities. Scientific studies show a drastic decline in Monarchs as the population is vulnerable to threats like severe weather changes, climate shifts, and pesticides. Altered weather conditions and climate are affecting species and accelerating extinction risk in multiple ways such as loss or degradation of important habitats and microhabitats; changing of environmental thresholds; loss of important interactions between two unrelated species, or the arrival of new, negative ones; the disruption of environmental cues (e.g., for breeding or migration); the direct loss of individual organisms, or even populations, as a result of extreme events. (https://www.iucn.org/theme/species/our-work/species-and-climate-change).

Carrie Arnold (2018), in " We're losing monarchs fast—here's why", has stated that the longest known insect migration [of Monarchs] is disrupted, "The culprit? Humans. The twin forces of human-caused climate change and habitat loss are now threatening North American monarch butterflies with extinction" (p.1). ICUN RED list (https://www.iucn.org) status does not consider Monarchs as an endangered species but recognizes their migration as an endangered phenomenon. Cheryl B. Schultza, Leone M. Brownb, Emma Peltonc, Elizabeth E. Crone (2017), in

their work “Citizen science monitoring demonstrates dramatic declines of monarch butterflies in western North America”, has predicted the vulnerability of the monarch butterfly species due to anthropogenic activities like the consumption of fossil fuels, the acidification of the oceans, pollution, using pesticides, deforestation, and forced migrations.

Kingsolver, in her essay collection *Small Wonder* (2003), has also mentioned the adverse effect of using pesticides on Monarchs that are migrating and nesting in the United States from Mexico during winter. In her essay **“A Fist in the Eye of God”,** she states how genetic engineering is tampering the nature’s rule, the rules of God’s laboratory. Human technological advances for genetically modified food and crop yielding are producing unforeseen consequences. Kingsolver points out that the genetic engineers have spliced a bacterium, *Bacillus Thuringensis*, into a corn plant. This germ causes caterpillars’ stomachs to explode but has no harmful effect on humans, birds, ladybugs. It is one of the most useful pesticides that human laboratory has ever produced. But this bacterium is pushing the populations of Monarch butterfly into the risk of extinction as it may explode the stomach of any butterfly larva. The populations of monarch butterflies migrate all the way to Mexico and back on wings are plummeting fast. There are many other reasons for this decimation of the species, namely, their winter forests in Mexico are being burned. But the destructive role of an engineered pesticide as a stomach explosive is undeniable to any reasonable human imagination. Monarch butterflies are more obscure and more endangered and on the verge of extinction.

***Small Wonder*: "The Patience of a Saint", "Seeing Scarlet", and "Setting Free the Crabs"**

"**The Patience of a Saint"**, cowritten with Kingsolver's husband, Steven Hopp for a natural history magazine, recounts teaching her children the eternal value of rivers in the Arizona desert. San Pedro, a hostile piece of land, is an important migratory corridor and a natural habitat protected since 1988 as the San Pedro Riparian National Conservation Area and the nation's "Last Great Places" (Kingsolver 43). The river is life to a rich extravaganza of flora and fauna. Rare species like the Huachuca leopard frog, the brush-prowling ocelot, and the bright-feathered birds thrive in this hostile expanse of land across nearly half the river's hundred miles and fifty-eight thousand acres of the corridor. For eighty-two species of mammals, forty-three kinds of amphibians and reptiles, 385 inland avian species, and the winter nesting and breeding ground of millions of migratory birds from the U.S. and Canada, San Pedro is home. But this riparian species extravaganza is threatened by agriculture and population growth. Only five percent of the original pristine forest still stands. Many orders of animals and plants have perished quietly. Of the fourteen native species of fish, twelve are now extinct. The landscape of the San Pedro river has witnessed the boomtowns whose economies lived and died because of the mining of copper ore. The toxic by-products are dumped in the river, which has led to the decimation of aqua species.

"Seeing Scarlet", another essay co-written with Steven Hopp, documents her visit to Corcovado National Park on the Osa Peninsula. Kingsolver treks to Talamanca Highlands on a pitted, winding highway searching for the natural habitat

of *Ara macaw*. The Osa Peninsula is a biologically rich tropical habitat and protected home of the Central American population of globally endangered birds, Scarlet or Ara macaws. With sparse human settlements, Osa provides the richest biodiversity with 400 avian species and 140 mammals. Biologist Scott Anderson in his study *Dependent Environmentalism: A Case Study of Oreros and the Corcovado National Park in Costa Rica* (2003), describes that Costa Rica, like all of Central America, has various environmental and economic problems such as loss of remaining forest due to deforestation, soil degradation, rapid population growth, inflation, high unemployment, the dedication of country's most productive land to export and ranching, etc. (Anderson 23). This has definitely affected the ecosystem of Osa, making the endemic scarlet macaw population vulnerable to Anthropocenic threats such as habitat loss, the pet trade, and captive breeding for trafficking. Scarlet Macaws or Ara macaws are classified as threatened (Appendix I) under the Convention on International Trade in Endangered Species (CITES). Kingsolver describes how the *Ara macao* has become a natural prey for poachers and smugglers. The international trade of scarlet macaws is banned (CITES), but illegal capture, nest poaching, and captive breeding for trade continue to rise alarmingly. The illegal wildlife trade is the third largest and biggest trade after arms and drug trade, and the estimated value of this trade is US$ 10 billion a year, as per Interpol. The black market of pet parrot trade is a significant part of international wildlife trafficking and trading. It is threatening extinction to sixty-six parrot species globally, including twenty-seven in south America (ICUN 2008). Kingsolver documents these as 'extinction stories'. Her views on extinction resonate with Heise in *Imagining Extinction* (2016), that these extinction narratives "seek[s] to convince readers that

the current biodiversity loss is a major crisis, that we do not care enough collectively, that we need to care and do more to rescue species at risk" (2).

"**Setting Free the Crabs**" also echoes similar concerns about nonhuman species. In this travel essay, she documents the extinction of the hermit crabs due to increased human actions. By hoarding seashells, which are home to the hermit crabs, immense damage is caused to their habitats. Added to this, the ocean water and seashore pollution due to the dumping of waste has triggered their decline. Hermit crabs are also over-picked for pet trade, and hence illegal pet traders target these sea creatures for profits. Quoting Al Gore's *Earth in Balance,* Kingsolver discusses the human efforts of 'othering the nonhuman'. This has a long history of domination of animal species who are existent only for our use. This attitude has gone through changes but at the cost of "losses at our peril" (qutd in Kingsolver 67). The pulsating life of the 'other' species, facing the threat of extermination, places humans with a choice to reconfigure their relations with the nonhumans: "Decisions about biodiversity are in the end questions about value, about cultural frameworks of thought, and about historical traditions of social practice" (Heise 233). Elsa Youngsteadt et al. in *Ecology in the Sixth Mass Extinction: Detecting and Understanding Rare Biotic Interactions* (2016) points out the rapidity and the expanse of the destruction. She explains how the planet earth is experiencing a wave of anthropogenic biodiversity loss. The current rates of extinction are 100–1,000 times more than the rate observed in prior mass extinctions in the fossil record. These losses place earth's biota in the early stages of an extinction event, comparable to those precipitated only five times in the past 540 million years (70). Kingsolver's

words are deeply critical of this dire effect of the Anthropocene that witnesses the human's changed relationship with other species:

> When humans decide to work our will, we are so tragically efficient. Now that we've used up all the prairie, we've taken to burning the rain forests to clear pasture for fast-food beef, slashing and burning a new plot of it the size of Tennessee each year, without much of anyplace left to go after that. In the meantime, and largely as a result, the rate of species extinctions has reached astounding new highs; many scientists predict we will lose about a quarter of the world's wildlife over the next two decades (Kingsolver 64).

***High Tide in Tucson*: "Infernal Paradise", "Memory Place"**

"Infernal Paradise", a more or less travel essay, narrates Kingsolver's visit to Haleakala, the world's largest dormant volcano, in Hawaii. She describes "the precipice of a wilderness" and "lunatic landscape" as "Haleakala is entirely of the earth, and nothing of human artifice" (Kingsolver 196). The unique topography of Haleakala Crater creates its own weather. Parts of the high-altitude crater are scorching and barren, while other parts are freezing cold by frequent rain and have lush fern forests. Kingsolver describes the strange landscape created from a volcanic eruption a million years ago, is a repository of species unique to Haleakala. Natural selection led the native species to evolve in species that are unique in the world: the Silversword, for example, a plant that lives in lava beds and dies in a giant flowery starburst; or the n n, which is a crater-dwelling goose, that has lost the need for webbed feet because it shuns the sea. "Over the course of a million years, hundreds

of creatures like these evolved from the few stray immigrants. Now they are endemic species, living nowhere on earth but here" (Kingsolver 197). Kingsolver further describes the anthropogenic invasions that have pushed these exotic species and the Hawaiian forests first endangered and then extinct. Every human immigration has brought new invasions to Hawaii. Sugar cane and pineapples have filled the valleys, crowding out native herbs. Logging has decimated the endemic rain forests. Without native carnivore and predators, exotic or alien animal species flourished in the land: "more species have now become extinct in Hawaii than in all of North America. At least two hundred of the islands' endemic plant species are gone from the earth for good, and eight hundred more are endangered" (Kingsolver 198). She describes the fate of the dazzling Silverswords, that grows nowhere else on earth. This endemic plant is collected as souvenirs, leis, for scientific studies, and oriental medicines. Once found abundantly in the 1873s in the Haleakala's ground, these magical plants have declined to a countable number by the 1930s. The n n suffered an even more dire decimation, nearly following the dodo. By 1951, only thirty-three n n geese are alive, and half of them are in zoos. The whole ecosystem of Haleakala is endangered.

This observation on the strange appetite of humans leaves her questioning the general human disregard for nature, species life, and environmental future of our planet: "How can we proceed with such pure disregard for the ones who will come after—not just our own heirs, but all of life?" Kingsolver quotes Linda Hogan in Heart *of the Land* (1994): "We need to reach a hand back through time and a hand forward, stand at the zero point of creation to be certain that we do not create the absence of life, of any species, no matter how inconsequential it might appear to be" (qtd in Kingsolver205).

Anthropocene: Increasing Climate Disruption

Climate scientists David Archer and Stefan Rahmstorf, in *The Climate Crisis: An Introductory Guide to Climate Change* (2010), have contested the scope of science as prediction narrative:

> Climate models are our crystal balls to get a glimpse of the future, an age-old dream of humanity. But what they offer is not a *prediction* —rather, it comes as a bundle of scenarios …Natural scientists can in principle not predict the future of climate, because it depends on human actions…That is a matter of choice, not a pre-determined future that can be calculated today. What we can do, however, is calculate scenarios in "what if" style (Archer and Rahmstorf 126).

Antonia Mehnert in *Climate Change Fictions: Representations of Global Warming in American Literature* (2016) has explained that the importance of climate change literature lies in presenting images of an unfamiliar future by reframing scientific data. These images provide an insight into the various aspects of human struggle and potential conflicts in altered environments due to climate change. She further quotes Robert Macfarlane ("The Burning Question", 2005), who underscores such significance of literature that presents "hypothetical situations—alternative lives, or futures, or landscapes—as though they were real" (qtd in Mehnert 8). She explains that literature makes a significant contribution to our understanding of climate change as the cultural repertoire of future imaginaries. It is essential to reflect and reassess these future imaginaries to create more sustainable futures (9).

Climate change is connected to science, and thus climate change fiction contributes to develop or build a new culture of scientific studies, “a bidirectional exchange of ideas between literary and scientific studies” (Trexler 23). Climate fiction, as “a bidirectional exchange of ideas between literary and scientific studies”, is wide in scope as a *prediction narrative*. Climate fiction is what Adam Trexler (2015) designates as a fabrication distinct from the pure representation of scientific truths. Cli-fi offers fictional works representing the effects of anthropogenic climate change “speculated on a possible future” (Trexler 27) and as a caution to humanity. Thus, cli-fi is both prediction narratives and “cautionary tales” (Heise 13):

> Climate fiction can convey cultural narratives, create detailed speculation, incorporate diverse points of view, and hold a multitude of things, from species to machines, places to weather systems. These features make the novel a privileged form to explore what it means to live in the Anthropocene moment (Trexler 27).

Barbara Kingsolver’s works, depicting climate disruption, correspond to these features of being both prediction narratives and cautionary tales. They describe the catastrophic effects of climate change from local to planetary scales and integrate the newer and more persistent concern of Anthropocene.

Flight Behaviour **(2012)**

Flight Behaviour (2012) is set in rural Tennessee, Appalachia. The fiction's primary focus is climate change, but it addresses more persistent issues related to the environmental crises. In her interview with Steve Curwood, Kingsolver states the

importance of the "generational" migratory pattern of monarchs for the survival of this exotic species. Kingsolver in the novel through the character Ovid Byron, who is a scientist, explains this migration phenomenon: "this system of local and universal genetics makes a kind of super-insect. The population can fluctuate fivefold in a year. It's an insurance policy against environmental surprises" (Kingsolver 318). But the monarchs have to shift their "home place" because of climate change.

> It's an immense congregation of Monarch butterflies. Normally, these butterflies congregate, aggregate for the winter in the high mountains of central Mexico. In this case, I imagined a circumstance in which their migratory system is so disrupted that they would shift their aggregation to very similar mountain in southern Appalachia (Kingsolver in Curwood, 2012, http://www.loe.org/)

Antonia Mehnert (2016) in *Climate Change Fictions: Representations of Global Warming in American Literature* has explored how Kingsolver interweaves the crises of global warming and climate disruptions in the text. This requires a multi-dimensional thinking pattern among scholars. The nonhuman turn is posed in the novel with the focus on global warming and species decimation: "the butterfly phenomenon up on the hill discloses how the human and the non-human together form part of one complex and interdependent system that climate change is threatening to disrupt" (61). Patrick Murphy's article "Pessimism, Optimism, Human Inertia, and Anthropogenic Climate Change" (2014) discusses the title of Kingsolver's fiction, "Flight Behaviour". Murphy states that the title refers to two types of behaviour: the protagonist's (Dellarobia's) growing self-awareness and the

migration of the Monarchs. The ‘second behaviour’ focuses on the scientific investigation of the Monarchs’ historic multigenerational migration pattern and the alteration of this migration pattern due to climate change. Murphy states that Ovid Byron, the scientist in the novel, correlates between this phenomenon and the impacts of climate change on flora and fauna. The ‘second behaviour’ gives the readers ample opportunity to gain insight into the disruption of seasonal cycles and the temperature gradients that induce relocation and possibly the extinction of numerous species lives on earth, such as the Monarchs in the novel *Flight Behaviour* (158). The scientific *alter ego* of the novelist is depicted in the novel in the form of Ovid Byron. Byron’s focus on the scientific explanation behind the monarch’s distorted migration path gives an insight into Kingsolver’s mind and the dark future of the planet. Adam Trexler in *Anthropocene Fictions* (2015) reflects that the majority of climate change novels present a local disaster, which makes global warming undeniable and immediate. Kingsolver’s novel builds a complex and moving portrait of the contemporary Anthropocene (226). Instead of focusing entirely on the disaster trope, the reversal of the flight direction of the millions of monarch butterflies represents the main crisis of the novel. Therefore, climate change is a devastation both for human and nonhuman species:

> The monarchs had to leave the Mexican roost sites earlier every year because of seasonality changes from climatic warming. She wondered whether any of this was proved. Climate change, she knew to be wary of that. He said no one completely understood how they made these migrations. Hundreds of factors came into play. Bio-geography, roosts, host plants, overwintering zones, loss of something communities, devastation. That one she got, devastation (Kingsolver 82).

***Animal Vegetable Miracle: A Year of Food Life* (2008)**

Animal Vegetable Miracle: A Year of Food Life (2008), co-written with Steven Hopp and Camille Kingsolver, narrates Barbara Kingsolver's family decision to relocate to a farm in Virginia, leaving arid Arizona and sustaining on locally grown food. Kingsolver's emphasis on becoming a locavore (local food consumption) is ecologically sustainable for humans and the environment. It boosts the local economy and promotes sustaining on fresh, tastier, and healthier food consumption limiting the carbon footprint. The issues focused in *Animal, Vegetable, Miracle*, are: smaller local farms concentrating on redistributing the land, growing a wider range of food species, maintaining the soil and nutrition level of crops or food growth, and promoting small-scale or local marketing systems. Being a locavore strengthen the bonds with the local community, personal relationships with the local farmers and sellers and also help to protect the environment in a way reducing the carbon footprint of an individual's food purchase and consumption. Rachel Shindelar in "The Ecological Sustainability of Local Food Systems" (2015) has stated that,

> The most prominently voiced reasoning behind this is the reduction of GHG emissions that would result from the decrease in transportation requirements. A straightforward and plausible concept, deliberately purchasing and consuming local products has quickly become a core strategy for reducing individual and institutional GHG emissions and is perceived as the motivation behind the "locavore" movement (Shindelar 19).

But the concept of local food consumption or locavore may vary from system to system based on the region and community in which the local food system is grounded. This is also at the core of *Animal, Vegetable, Miracle* as we find the Kingsolver family moving from Tucson, Arizona to Appalachia. But the local food system is more ecologically sustainable, and Kingsolver seeks to emphasise that idea in the subtitle "food life". As local consumers, they choose products based on their social, economic, and ecological needs, and that has an impact on the environment and ecological footprint of their diet. Rachel Shindelar (2015) reflects that "consciously choosing to participate in alternative local food systems instead of the conventional food system is a sure way to increase your access to environmentally friendly food and to support more ecologically sustainable agricultural practices" (23). Kingsolver also mentions that agriculture and food production account for a significant amount of anthropogenic greenhouse gases. She states the average person's notion of consuming food products that "been seeded, fertilized, harvested, processed, and packaged in grossly energy expensive ways and then shipped, often refrigerated, for so many miles" (Kingsolver 114). Therefore, the ecological footprint of our diets is increasing the effects of climate change.

In this context of locavore, it is important to mention the concept of "food miles", which supports the consumption of local produce. The carbon footprint for food miles is calculated by multiplying the distance the food (or each food ingredient) has travelled by the carbon emission of the transportation type, airplane, truck, barge, or railroad (MacDonald and Reitmeier 308). Vanishree M and Sendhil R (2018), in their study "From Farm to Plate: Why You Should Worry About the Distance Your Food Travels", have pointed out the concept of "food miles" in the

context of measuring carbon footprints. They explain that "food miles", as a concept, originated in the early 1990s in the United Kingdom by Tim Langat at the Sustainable Agriculture Food and Environment (SAFE) Alliance. Food miles first appeared in *The Food Miles Report: The Dangers of Long-distance Food Transport,* researched and written by Paxton (1994). The concept of food miles is one of the factors used to assess the impact of environmental and regional development owing to food transport, including the impact of global warming or climate change. Food miles are a measure of how far a food item has been transported from its site of production to its site of consumption (Rama and Lawrence 2008). It has significant environmental concerns related to measuring the food transport and consequent pollutants released by the transportation of the food items. Higher food miles consume greater amounts of energy. They have a complex impact on the food system, such as energy use and contribution to climate change, dependence on fossil fuels, traffic, and congestion, as well as social and economic impacts on rural communities. According to Food Miles Report 2005, road, air, rail, and sea transport produce 60%, 20%, and 10% of the world's food transport carbon emissions, respectively (2).

Anthropocene: Growing Toxicity of Ecosphere

With the publication of Rachel Carson's *Silent Spring* (1962), the general readers' attention is diverted towards the "toxic discourse" and thus marks the beginning of toxic narratives. Toxic narratives portray realistic and more crises-oriented images of environmental hazards and disruption. *Silent Spring* focuses on the textual representation of the contexts of chemical pesticides and radioactive

fallouts. This pivotal cultural document captivates the reader's attention to these twin toxic hazards. Carson has effectively fused the pre-existent pollution concerns of urban and industrial reformers to the ecological sensitivities of resource conservation and wilderness preservation (Walker 322-325). John Clark in the "Introduction" of *Environmental Toxicology: A Legacy of Silent Spring* (2004), states that although genetic and other ecological 'mega-hazards' have been added to nuclear and chemical threats, the *fable for tomorrow* retains its resonance as a powerful allegory of the 'Risk Society' (Clark viii). Ursula K. Heise, in her seminal article "Toxins, Drugs, and Global Systems: Risk and Narrative in the Contemporary Novel" (2002), has discussed the popular perceptions of *toxic risk* (emphasis is mine) in an ecocritical context. Explaining the cultural variables of risk analysis, she argues that *the perception of risk* profoundly affects the representation of nature/environment in literary and non-literary texts and an individual's response to the environment (Heise 763). Following Carson's book, a range of new fictional and non-fictional narratives have emerged to frame what Lawrence Buell designates as 'toxic discourse', "textual and visual representations of exposure to hazardous chemicals" (Heise 747). Buell explores toxic discourse as "a possible prototype of environmental imagining" that redefines human interconnection with the physical environment in a unique manner:

> The modern nature that toxic discourse recognizes as the physical environment humans actually inhabit is not a holistic spiritual or biotic economy but a network or networks within which, on the one hand, humans are biotically imbricated (like it or not) and, on the other hand, nature figures as modified (like it or not) by techne. This view is neither preservationist, given its recognition of the impact of human powers and the

> legitimacy of human needs, nor conservationist, since its goal is not resource management so much as effective symbiosis (Buell 657).

In her fictions, Kingsolver describes the manner in which the chemical toxicity has challenged both the ecosystem and human 'health'. Increasing toxicity has become the significant detriment in the efforts to manage and protect the environment for the wellbeing of the planetary ecosystem. Her novels are significant contemporary studies on toxicity that commenced with the publication of Carson's *Silent Spring* (1962). Terrell Dixon in "The literature of toxicity from Rachel Carson to Ana Castillo" (1996), has surveyed the growth of toxic studies in the literary works of Rachel Carson (1962), Don DeLillo (1985), Terry Tempest Williams (1991), Jane Smiley (1991), Rudolfo Anaya (1993) and Ana Castillo (1993). Dixon further states that the creation and manufacture of toxic materials have significantly increased. Various authors' literary efforts to oppose these environmental degradations are multiplying and diversifying: "It is not surprising that we now have an important group of writers who fall into a grouping which should be called 'the daughters and sons of Rachel Carson" (Dixon 256). Barbara Kingsolver is the newest inclusion to this writers' list as her fictional works resonate with these writers' creations. She can be designated as one of 'the daughters and sons of Rachel Carson' as her works focus on the contemporary literature of toxicity similar to these writers mentioned above.

Toxic Metal Mining: *Animal Dreams* (1990)

Animal Dreams (1990) recounts Codi or Cosima's return to the "country of her origin" (Kingsolver 211), a small rural town, the Grace County. She describes 'poisoned grounds' of Grace County polluted with the chemical extracts, sulfuric acid, from the copper mine, Black Mountain Mine. Mary Allen Snodgrass in *Barbara Kingsolver: A Literary Companion* (2004) comments that the text depicts the slow strangulation of Grace, Arizona, and the wilful acidification of the river from the leachate of copper trailing (33). The river is getting polluted; the ground is losing its fertility, and the trees are dying. Grace is set in a fertile valley, although it being a mining town. Therefore, people grew orchards for livelihood, and now the orchards are dying because of the industrial expansion. The locals depending on the orchards, are helpless before the *leaching operation*, "they're getting gold and moly out of them tailing piles. If they weren't, they wouldn't keep running the acid through them" (Kingsolver 64). The mine represents the capitalist world. It changes the landscape to a deathscape:

> The dead mountain range of tailings on the lip of the mine had sat for decades, washed by rain, and still was barren as the Sahara. From a distance you might guess these piles of dirt to be fragile, like a sandcastle, but up close you'd see the pinkish soil corrugated with vertical ridges and eroded to a sheen, like rock. It would take a pickaxe to dent it (Kingsolver 48).

The silent poisoning of the land and water turns Codi into an activist for the river. The government EPA (Environmental Protection Agency) is unconcerned

about this environmental degradation. With her knowledge of chemistry and biology and as a woman, Codi's perceives the destruction of land, and she becomes a part of the women founded "Stitch and Bitch club" who are protesting and organizing demonstrations against this annihilation of their environment. Whereas the men in the town sit and talk for "about nine and ten hours" (Kingsolver 68), becoming more impotent in front of the mine's capitalistic powers, the women exhibit the spirit to resist destruction. *Animal Dreams* (1990), which is based on Kingsolver's freelance journalistic writing *Holding the Line: Women in the Great Arizona Mine Strike of 1983* (1989), echoes the toxic discourse of the environment caused by mining in Arizona. The non-fiction is a collection of interviews of miners and their families, particularly the women who face the challenge of the strike. It accounts for the strike against Phelps Dodge Copper Corporation from June 1983 to December 1985 (approximately 18 months). Kingsolver was fascinated by the real-life activities of the women of the mining community. The fictionalised "Stitch and Bitch club" in the novel recounts the women's stories who were actually holding the line in the Arizona copper mine strike in 1983.

The pressing environmental concerns related to any metal mining applies to copper mining also. Such mining operations physically disturb landscapes because of the mine workings, waste rock, and tailings disposal areas. Mining also increases the acidity of soils, making soils toxic to any vegetation, and such poisonous soils are a source of metals released to the environment. It also degrades surface and groundwater quality as a result of the oxidation and dissolution of metal-bearing minerals. It also accelerates air-borne dust and other emissions, like sulfur dioxide and nitrogen oxides from smelters, thus polluting the atmosphere and surrounding

areas (Hudson et al. 7). Kingsolver focuses on this question of ecological degradation by reconfiguring toxic stories on a human scale. *Animal Dreams* resonates with all the severity of toxic concerns related to copper mining. The river pollution, poisoned and infertile land, the loss of trees and fruit orchards, and natural vegetation of the fictitious Grace County make the readers acquainted with an Anthropocenic threat that they tend to believe as real but not imminent or severe. Thus, Kingsolver, the environmentalist, narrates the present that is threatening the planetary existence.

Toxic Agriculture Practice: *Prodigal Summer* (2000)

Barbara Kingsolver's *Prodigal Summer* (2000) presents three parallel strands in the novel, namely, "Predators", "Moth Love" and "Old Chestnuts". Seemingly different from each other, the three strands converge to evolve into an interconnected ecological tapestry towards the end. The strand "Moth Love" is the story of Lusa Maluf Landowski, the bug scientist, studying moths. She marries the farm owner Cole Widener and moves to this farming community with him. Cole's death in an accident leaves Lusa adjusting with his five sisters' families and the dying farm. Cole's sisters want to plant tobacco on Cole's farm property, but Lusa refuses to do so. Lusa considers tobacco "a drug": "We're sitting on some of the richest dirt on this planet, and I'm going to grow drugs instead of food?" (Kingsolver 105). She baffles her in-laws as she wants to grow something profitable but not tobacco. The other farmers in the area hardly try anything else to grow successfully than this cash crop. Here, Kingsolver points out that most farmers are ignorant of the environmental toxicity that tobacco farming causes. Agricultural practice of tobacco

growing involves many environmental issues like degradation of land and water use, use of pesticides, deforestation due to land clearing for farming. Tobacco farming involves a considerable use of chemicals such as pesticides, fertilizers and growth regulators of leaves. Often these chemicals affect nearby water resources of the tobacco farming fields. Research has also shown that tobacco crops deplete soil nutrients by taking up more nitrogen, phosphorus and potassium than other major crops. This depletion is compounded by topping and de-suckering plants, which increase the nicotine content and leaf yields of tobacco plants (Policy and Practice, *Bull World Health Organ* 2015;93:877–880). In short, this cash crop reduces the fertility of soil rapidly as well as increases the soil depletion. Deforestation is another issue that is associated with tobacco growing. Forests are cleared for this agriculture practice and deforestation contributes to emissions of greenhouse gas and climate change. Deforestation and tobacco-driven habitat fragmentation also cause widespread biodiversity loss. It is also associated with land degradation or desertification in the form of soil erosion, reduced soil fertility and productivity, and the disruption of water cycles (WHO Studies, 2017). In the FCTC policy options and recommendations to economically sustainable alternatives to tobacco growing (FCTC/COP6 (11)), it is researched that the global share of agricultural land used for tobacco growing is less than 1%, its impact on global deforestation is higher. Tobacco is a mono-crop, and it depletes soil nutrients. It is a high input-oriented crop, and the per-acre requirement of pesticides and fertilizers is very high under certain conditions. Therefore, tobacco ranks among the ten crops with the highest fertilization rates. (www.who.int/entity/fctc/treaty_instruments).

In this connection, it is significant to note the reality of tobacco farming in accelerating environmental pollution and toxicity levels. According to the report (2018) of FCTC (WHO) and UNDP, tobacco production "tremendously destructive" for the environment ranging causing deforestation, soil degradation, and pollution and damaging the impact of climate change. According to the Head of the WHO FCTC, Dr. Vera Luiza da Costa e Silva, environmental pollution from tobacco starts well before cigarettes are discarded, during the production phase, as tobacco crops require large amounts of chemical fertilizers, pesticides, and growth regulators that pollute the ground, nearby waterways and aquifers. The process presents serious health hazards for farmers and their families:

> Among the pesticides used to grow tobacco are some highly toxic products that affect animals and humans alike, many of which are banned or being phased out in several countries," explained Dr. da Costa e Silva, who added that the manufacturing of cigarettes also contributes to high greenhouse emissions responsible for global climate change (who.int/fctc/medicentre/news/2018).

In the FCTC policy options and recommendations to economically sustainable alternatives to tobacco growing (FCTC/COP6 (11)), it is said that the occupational risk is high for the tobacco farmers. Several occupational risks related to tobacco growing are well known, including green tobacco sickness and, as in many other agricultural sectors, pesticide intoxication, respiratory and dermatological disorder, sand cancers. Green tobacco sickness is most specifically related to tobacco growing, results from dermal absorption of nicotine, which is

exacerbated during the handling of wet leaves, but which may be preventable by the use of appropriate individual protective equipment.
(www.who.int/entity/fctc/treaty_instruments).

Kingsolver infuses this ongoing ecological calamity in her fictional storyline, bringing the readers' attention to toxic and damaging environmental practices. Hence, Lusa's perception of the cash crop as a "drug" actually voices Kingsolver's concern about the land and water toxicity involved in tobacco farming. Kingsolver also suggests alternative and more sustainable ways of farming. Lusa starts goat rearing that solves the problem of weed-growth on the farm, and is a more environmental-friendly way of farming and saving dying Widener farm.

Conclusion

Richard Steiner, the conservation biologist in his article "From Anthropocene To Ecocene by 2050?" (2017), has stated that the ecological footprint of humanity is enormous and beyond the earth's carrying capacity. The anthropogenic actions have resulted in the extinction of half of the world's forests, grasslands, wetlands, and mangroves (1). Human use of fifty percent of natural resources and freshwater, thousands of species extinctions, climate disruption, rising sea level, increase of desertification, acidification of oceans, and spreading toxicity map the global trajectory of planetary decline in Anthropocene. It is hard to comprehend the magnitude of the present environmental crises, as marked by Jeremy Davies in *Birth of Anthropocene* (2016).

He explains that we might have started to make sense of what we are facing: “the idea of Anthropocene epoch lets us understand the ecological crises of the present day in the context of distant past…To make sense of climate change, biodiversity loss, rainforest logging, and the rest, pay attention to how the current and imminent states of the world compare to those seen in the various epochs that went before” (2). Kingsolver’s anthropocenic fiction and non-fictional writings foreground the increased need for environmental awareness and knowledge about the long-term resilience and vulnerability of human-nature entanglements and climate crises. She emphasises that the survival of the planet depends on the existence of highly specialised and sustainable forms of human-nature entanglements and social organisations with the unique capacity to persist in the climate change scenario. Her works envisage a new understanding of the present environmental crises and seek to radically alter our knowledge of emergent, long term human-nature entanglements and ecologies thriving on disruption.