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Exploring Three Levels of Biodiversity: Genetic, Species, and Ecosystem, as Presented in the Qur'anic Verses

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ABSTRACT: Original Paper

Today, the world faces environmental crises that have led to the loss of biodiversity. Biodiversity, which is essential for the processes supporting all life on Earth, refers to the variety of life at all levels-ranging from genes to ecosystems-and is classified into three levels: genetic, species, and ecosystem diversity. This research, employing a descriptive-analytical approach and based on careful interpretations, examines the scientific concepts related to the three levels of biodiversity as mentioned in the Holy Qur'an, to highlight the importance of biodiversity for the continuity of life, which is addressed in various forms within the Qur'anic verses. The results show that at the genetic diversity level, there are verses expressing genetic variation within the human species and other organisms. At the species diversity level, numerous verses reflect the diversity among plants and animals from different perspectives. At the ecosystem diversity level, some verses refer to the variety of ecosystems present on Earth, including forests, grasslands, gardens, agricultural lands, pastures, rivers, mountains, valleys, deserts, marine environments, and others. Overall,

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the research results indicate that many Qur'anic verses emphasize the diversity of life and its components.

KEYWORDS: The Qur'an and Biology, Biodiversity, Genetic, Species, Ecosystem.

1. Introduction

The Holy Qur'an conveys profound layers of meaning that reveal the secrets and mysteries of the universe. Throughout history, the quest to uncover these meanings has captivated researchers. Over time, the Qur'an has not only remained relevant, but its miraculous aspects have become increasingly evident, and the greatness of its content has become clearer to the world. As Imām al-Ṣādiq (PBUH) states in a narration: "God Almighty has not designated the Qur'an for a specific time or a particular group. For this reason, it is new in every era and among every group until the Day of Judgment" (Makarem Shirazi 1996). This divine book, while presenting the most important characteristics of the entirety of existence-meaning everything other than God-enumerates significant traits of the natural world, such as creation, dependency, total reliance for survival, order and causality, the diversity and variety of beings, the existence of consciousness and perception, the vitality and glorification of all natural beings, the specific functions of natural entities, and divine sovereignty over all of nature; these are just a few examples. Islam is among the religions that, unlike other non-religious beliefs, have removed the sacred status of the natural world from an epistemological perspective and established it as a field for human study and exploration (Qorbani 2015).

Based on this foundation, the examination of the status of natural sciences in the Qur'an has garnered scholarly attention. For instance, Aliwi (2024) explored the collection and analysis of verses related to scientific facts and cosmic phenomena, employing an inductive and descriptive approach. Blankinship et al. (2024) reviewed Qur'anic verses pertaining to biodiversity and their alignment with the United Nations Sustainable Development Goals (SDGs), identifying twenty-one verses aligned with four SDGs (Goals 12–15). Najafi (2016) focused on verses Q.13:3 and Q.51:49 to explore the universality of the pairing of beings, concluding that the widespread presence of male and female pairing across humans, animals, and plants serves as a reminder for humanity

to acknowledge the power, wisdom, and uniqueness of God. Qorbani (2015) demonstrated that natural science teachings in the Qur'an, while revealing aspects of nature, represent one of the most important means of knowing God and shaping a divine worldview that leads to true human happiness. Muhamad (2015) analyzed the Qur'anic instructions concerning the immense value of biodiversity as described by God, categorizing the related verses into two main groups: those pertaining to animals and those pertaining to plants. Solihu (2014) examined biological diversity from the Qur'anic perspective, aiming to clarify the kinds of value the Qur'an ascribes to non-human species, finding that non-human species are presented in the Qur'an as signs of God. Nasiri & Naghdi (2010), by exploring the miracles and wonders of the Qur'an in animal biology, showed that the Qur'an revealed the book of creation long before modern science, using simple language for humanity.

To understand the various dimensions of nature, familiarity with biodiversity is of particular importance. Biodiversity is a fundamental characteristic of life, defined as the wide variety of plants, animals, and environments (Badeian & Yusefwand 2017). The life of the Earth depends on preserving its biodiversity. Even the smallest species in an ecosystem play crucial roles. In ecosystems, greater species diversity results in longer food chains and more complex life networks, producing a more stable environment with enhanced self-regulating capabilities. Therefore, studying biodiversity serves as an indicator for comparing the ecological status of ecosystems. A reduction in biodiversity can negatively impact both the quantity and quality of ecosystems (Badeian & Yusefwand 2017). Moreover, richer biodiversity supports economic development, opportunities for discovering new drugs, and adaptive responses to new environmental challenges, including climate change. Biodiversity holds ecological values such as preserving water and soil resources, nutrient storage and recycling, pollution breakdown and absorption, contributing to climate stability, and ecosystem restoration after unpredictable events (Shah 2014). It also carries religious and moral values (the belief that creatures are created by God), aesthetic and emotional values (the sense of wonder, respect, and reward evoked by biodiversity's beauty), and recreational and sports values (contributions to human physical and mental health).

Due to the importance of biodiversity, the United Nations has designated May 22 as the International Day for Biological Diversity. Biodiversity is not only accepted as a vital principle for sustaining life on Earth but also prompts philosophical reflection on the foundations

of creation. The Holy Qur'an, as a comprehensive divine scripture, presents a unique approach to biodiversity, which is examined in this research. Revealing the verses that mention different levels of biodiversity is crucial because, in addition to emphasizing the Creator's power in creating diverse forms, it highlights the importance of biodiversity for the continuity of life, as discussed across various verses.

The focus of this research is biodiversity, which can be studied at three levels: genetic, species, and ecosystem diversity (Adom et al. 2019). This study examines the verses of the Holy Qur'an from these three aspects through a descriptive-analytical approach. To this end, verses containing terms related to the three levels of biodiversity were initially identified using the website Qur'an.inoor.ir, and subsequently described and interpreted with reference to various scholarly exegeses.

2. Concepts and Terminology

Four important concepts that play a key role in this study are biodiversity, genetic diversity, species diversity, and ecosystem diversity, which are described below.

2.1. Biodiversity

The term biodiversity is relatively new. Historically, it was initially referred to as biological diversity by the wildlife scientist and conservationist Dasmann (1968). The term biodiversity is thought to have first been coined as a contraction of *biological diversity* in 1985 and was subsequently popularized by several authors (Adom et al. 2019). The International Union for Conservation Nature (IUCN) defines biological diversity as the variety of life on Earth, encompassing the number, variety, and variability of living organisms such as animals, plants, fungi, microbes, etc., as well as the genetic differences among them and the ecosystems in which they occur. Yucel (2015) divides biodiversity into three main components: genetic diversity, species diversity, and ecosystem diversity.

2.2. Genetic Diversity

A gene is a distinct sequence of DNA (Deoxyribonucleic Acid) that forms part of a chromosome and is inherited by offspring from their parents.

Genetic diversity refers to the different types and variations of genes within the chromosomes of a species (Whittaker 1967). Each member of any animal or plant species differs broadly from others in its genetic makeup due to the vast combinations possible within genes, which confer specific characteristics unique to each individual. For example, each human being is genetically different from all others. This genetic variability is essential for maintaining a healthy breeding population of a species. If the number of breeding individuals decreases, genetic dissimilarity is reduced, leading to inbreeding, which can ultimately cause the extinction of the species.

2.3. Species Diversity

The term *species* is defined as the most basic category in the system of taxonomy. Taxonomy is a scientific classification system that organizes organisms into hierarchical categories (kingdom, phylum, class, order, family, genus, and species) based on their biological characteristics. A species refers to a group of organisms that can interbreed and produce fertile offspring under natural conditions. Members of the same species share common features and genetic similarities. Species diversity refers to the variety of species within a particular region. For example, in a small river, the presence of plants, frogs, fishes, and snakes represents species diversity. Species diversity is also known as species richness, which reflects the extent of biodiversity resources at a site (Naughton et al. 2005). This richness depends largely on climatic conditions.

2.4. Ecosystem Diversity

An ecosystem is a complex assemblage of interconnected living organisms inhabiting a particular area or unit of space, along with their environment and all interactions among organisms and between organisms and their environment. There are two main types of ecosystems: terrestrial and aquatic. Terrestrial ecosystems, those existing on land, include examples such as desert ecosystems. Aquatic ecosystems occur in water bodies, such as ponds. Ecosystem diversity refers to the particular assemblage and interactions of species living together and their physical environment within a given area (McGrath 1999; Whittaker 1967). In fact, ecosystem diversity encompasses all different habitats, biological communities, ecological processes, and variations within individual ecosystems.

3. Biodiversity in the Qur'an

This section presents the findings from an analysis of Qur'anic verses related to the three levels of biodiversity, beginning with genetic diversity.

3.1. Genetic Diversity in the Qur'an

The following verses reveal insights into genetic diversity as described in the Qur'an. They highlight the natural variations among living beings that reflect God's creation:

> And among His Signs is the creation of the heavens and the earth, and the variations in your languages and your colors: verily in that are Signs for those who know (Q. 30:22).

This verse references the genetic diversity among humans, which leads to the emergence of different races. Biologically, a race refers to a grouping within a species distinguished by specific characteristics (such as skin color, hair, eye color, skeleton or body shape, blood groups, anthropometric indices, etc.). These races are differentiated based on many features, one of which is skin color. According to some interpreters, the difference in languages mentioned in this verse, in addition to variations in vocabulary and grammatical rules across languages, may also indicate differences in accents and variations in voice tones. This means it refers to the distinction in the tone of voice of one person compared to others, just as differences in color indicate diversity in skin tones (Tabataba'i 1999, 16:16). The uniqueness of individuals in tone of voice and color originates from their genetic differences, and fingerprints also exhibit such unique characteristics.

> And so among men and crawling creatures and cattle, are they of various colors. Those truly fear God, among His Servants, who have knowledge: for God is Exalted in Might, Oft-Forgiving (Q. 35:28).

This verse similarly emphasizes the diversity in color among humans and other living organisms, referring to the genetic diversity present within these beings.

3.2. Species Diversity in the Qur'an

The following analysis explores Qur'anic verses that illustrate the richness of species diversity, particularly among plants, highlighting nature's remarkable variety.

> It is He who sendeth down rain from the skies: with it We produce vegetation of all kinds: from some We produce green (crops), out of which We produce grain, heaped up (at harvest); out of the date-palm and its sheaths (or spathes) (come) clusters of dates hanging low and near: and (then there are) gardens of grapes, and olives, and pomegranates, each similar (in kind) yet different (in variety): when they begin to bear fruit, feast your eyes with the fruit and the ripeness thereof. Behold! in these things there are signs for people who believe (Q. 6:99).

Interpreters have proposed two possible meanings regarding the phrase *nabāt kulli shay'* (vegetation of all kinds). The first is that it refers to the diverse types and species of vegetation, all nourished by the same water and grown from the same soil. This highlights a miraculous aspect of creation, demonstrating how many different plants-with sometimes opposite properties and various forms-can coexist in one land and thrive from a common source of water. The second possibility is that this phrase refers to the variety of plants required by different creatures; meaning that birds, animals, insects, as well as sea and desert organisms, all benefit from these plants (Qara'ati 2004, 5:369; Sharīf Lāhījī 1994, 1:802; Al-Qumī al-Mashhadī 1989, 4:406). Both interpretations emphasize the diversity among plant species.

The term *ḥabban mutarākiban* (grain, heaped up) refers to plants with dense, clustered seeds such as wheat, barley, millet, and others. The verse also mentions the date palm, which similarly produces closely grouped fruits. Botanically, these plants share a compound spike inflorescence, yet despite this similarity, they exhibit significant differences, illustrating species diversity among plants. The phrase *mushtabihan wa ghayr mutashābih* (similar and different) highlights that trees like grape, olive, and pomegranate are similar in some features-such as leaf shape (e.g., olive and pomegranate)-but differ in others, such as fruit shape, signifying their diversity (Makarem Shirazi 1995, 5:368).

> It is He Who produceth gardens, with trellises and without, and dates, and tilth with produce of all kinds, and olives and pomegranates, similar (in kind) and different (in variety): eat of

> their fruit in their season, but render the dues that are proper on the day that the harvest is gathered. But waste not by excess: for God loveth not the wasters (Q. 6:141).

This verse refers to the diversity of plant species through two structural features: stem and fruit. It describes gardens with trellises (plants with herbaceous aerial stems that climb, creep, or twine because their stems lack rigidity) and without trellises (plants with upright, sturdy stems capable of growing independently). This distinction points to the variety of trees based on stem forms. Additionally, the verse comments on the fruits, which may be similar or different in taste, shape, color, and other characteristics.

> Of the cattle are some for burden and some for meat: eat what God hath provided for you, and follow not the footsteps of Satan: for he is to you and avowed enemy (Q. 6:142).

In the verse discussing *ḥamūlah* (cattle for burden), the term is understood as a collective noun that does not have a singular form, referring to large pack animals such as camels and horses. The word *farsh* (commonly meaning carpet) in this context is interpreted as sheep and other smaller animals. The implication is that these smaller animals stay much closer to the ground and, when viewed from a distance, a desert with grazing sheep appears like a carpet spread over the land, unlike a herd of camels, which does not present such an image (Tabataba'i 1999, 7:364; Al-Ṭurayḥī 1996, 5:35; Makarem Shirazi 1995, 6:8). Thus, this verse indicates animal species diversity in relation to human needs, fulfilling various purposes such as transportation, clothing, and nutrition.

> And in the earth are tracts (diverse though) neighboring, and gardens of vines and fields sown with corn, and palm trees - growing out of single roots or otherwise: watered with the same water, yet some of them We make more excellent than others to eat. Behold, verily in these things there are signs for those who understand! (Q. 13:4).

This verse begins by mentioning adjacent but diverse pieces of land, continuing to describe gardens and different types of trees like grapes, crops, and date palms. Interestingly, these trees and their various types sometimes grow from a single trunk and stem, and at other times from different bases. The term *ṣinwān* (growing out of single roots), plural of *ṣinw*, originally means a branch that comes out from the main trunk of

a tree (Al-Rāghib al-Iṣfahānī 1991, 494). Therefore, *ṣinwān* refers to the different branches that emerge from a single trunk. In botany, trees have a single main trunk, while shrubs have multiple stems branching from the ground. Thus, this verse refers to the diversity of species present in woody plants based on the type of main trunk.

> And the things on this earth which He has multiplied in varying colors (and qualities): verily in this is a sign for men who celebrate the praises of God (in gratitude) (Q. 16:13).

In this verse, the difference in colors of what has been created on the earth can be a metaphor for species diversity. In this case, the verse is closely related in meaning to Q. 13:4. Therefore, it indicates biodiversity in terms of species diversity.

> He, Who has made for you the earth like a carpet spread out, has enabled you to go about therein by roads (and channels); and has sent down water from the sky. With it have We produced diverse pairs of plants each separate from the others (Q. 20:53).

Azwāj (pairs) means varieties and kinds of plants that are close to each other, and *shattā* (diverse) means different (Al-Rāghib al-Iṣfahānī 1991, 385 & 445). Therefore, this part of the verse refers to the diversity present among plants, which indicates species diversity.

> And God has created every animal from water: of them there are some that creep on their bellies; some that walk on two legs; and some that walk on four. God creates what He wills for verily God has power over all things (Q. 24:45).

This verse categorizes animals based on their modes of locomotion: those that crawl on their bellies (reptiles and some amphibians), those that walk on two legs (some mammals and birds), and those that walk on four legs (some mammals and amphibians). This description implicitly corresponds to four major classes within the vertebrate phylum-reptiles, birds, amphibians, and mammals-highlighting species diversity at a higher taxonomic level.

Indeed, the mention of only a few types of animals is for the sake of brevity and conciseness; otherwise, the diversity of living beings is beyond counting. This diversity depends on the will of Almighty God. Therefore, at the end of the verse, it states that God's power is absolute, and thus all possible beings in their existence depend solely on His will. *When He decreeth a matter, He saith to it: "Be," and it is* (Q. 2: 117)

(Tabataba'i 1999, 15:137-138). Regarding the reason for mentioning these specific types of living beings in this verse, various interpretations and reasons have been presented by some commentators (Al-Rāzī 1999, 17:206; Al-Qurṭubī 1985, 13:292).

> He created the heavens without any pillars that ye can see; He set on the earth mountains standing firm, lest it should shake with you; and He scattered through it beasts of all kinds. We send down rain from the sky, and produce on the earth every kind of noble creature, in pairs (Q. 31:10).

In this verse, *min kulli dābbah* (beasts of all kinds) means all animals that have voluntary senses and movement (Ṭayyib 1999, 10:419), which refers to the diversity of different animal species. The expression *min kulli zawj* (every kind in pairs) refers to the male and female characteristics in some plants, which had never been discovered as a general principle at the time of the revelation of these verses, or it means different classes and types of plants, because diversity in the world of plants is extremely numerous and surprising (Tabataba'i 1999, 18:340; Al-Ṭabrisī 1993, 9:213), which refers to the diversity of different plant species. *Min kulli zawj* has also been mentioned in Q. 22:5, Q. 26:7, Q. 50:7.

> Seest thou not that God sends down rain from the sky? With it We then bring out produce of various colors. And in the mountains are tracts white and red, of various shades of color, and black intense in hue. And so among men and crawling creatures and cattle, are they of various colors. Those truly fear God, among His Servants, who have knowledge: for God is Exalted in Might, Oft-Forgiving (Q. 35:27-28).

Fruit is one of the reproductive organs of plants and contains a seed, which differs in different species in terms of appearance, including color. At the beginning of verse 27, the variety of species in plants has been mentioned with emphasis on the variety of fruits in terms of color. In the continuation of the verse and in verse 28, the difference in color among animals and the variety of animal species in terms of color have been mentioned. It should be noted that although the word *dawāb* (crawling creatures) means moving and includes *an'ām* (cattle: camel, sheep, and cow), but it is possible due to the importance and strong need of humans for cattle (Al-Rāghib al-Iṣfahānī 1991, 1:815), these three animals have been mentioned separately in the verse (Qara'ati 2004, 9:495). Earlier, in the discussion of genetic diversity, verse 28 was

mentioned, but with the above explanation, it can be said that this verse, in addition to genetic diversity, also refers to species diversity.

> He created you (all) from a single person: then created, of like nature, his mate; and he sent down for you eight head of cattle in pairs: He makes you, in the wombs of your mothers, in stages, one after another, in three veils of darkness. such is God, your Lord and Cherisher: to Him belongs (all) dominion. There is no god but He: then how are ye turned away (from your true Center)? (Q. 39:6).

The word *an'ām* means camel, cow, sheep, and goat, and for this reason, they are called eight pairs, because it is the sum of their male and female. Based on this, this verse refers to the species diversity of cattle used by humans (Al-Qumī 1988, 1:219).

> Seest thou not that God sends down rain from the sky, and leads it through springs in the earth? Then He causes to grow, therewith, produce of various colors: then it withers; thou wilt see it grow yellow; then He makes it dry up and crumble away. Truly, in this, is a Message of remembrance to men of understanding (Q. 39:21).

Zar' is a plant that does not have a strong stem, as opposed to a tree, which is often referred to a tree that has a strong stem. *Zar'* has a wide concept that includes non-food plants, all kinds of flowers and ornamental and medicinal plants and the like, which in terms of color; they are extremely diverse (Makarem Shirazi 1995, 19:423). Accordingly, in this verse, the diversity of ornamental and medicinal plant species has been mentioned based on color.

> It is God Who made cattle for you, that ye may use some for riding and some for food (Q. 40:79).

This verse, like Q. 6:142, refers to the diversity of animal species from the point of view of meeting human needs.

> Therein is fruit and date-palms, producing spathes (enclosing dates). Also corn, with (its) leaves and stalk for fodder, and sweet-smelling plants (Q. 55:11-12).

In these verses, species diversity among plants has been mentioned in terms of the type of fruit (palms with podded clusters), the type of seed (skinned seed) and the aromatic nature of some plants.

> And produce therein corn. And Grapes and nutritious plants. And Olives and Dates (Q. 80:27-29).

In verse 27, *ḥabb* (corn) refers to wheat, barley and other grains that grow from the ground. Although some scholars have considered its use only in wheat and barley (Tabataba'i 1999, 20:209; Ibn Manẓūr 1993, 1:294). In the following verses, the names of four other types of plants used by humans are mentioned, i.e. grapes, nutritious plants (*qaḍb* is a plant that is fresh and picked and eaten), olives, and dates. Based on this, these verses refer to the variety of plant species used in human nutrition.

3.3. Ecosystem Diversity in the Qur'an

The results of the investigation of the existing verses related to ecosystem diversity are given below (The verses are arranged according to the *Sūrah* number).

> From the land that is clean and good, by the will of its Cherisher, springs up produce, (rich) after its kind: but from the land that is bad, springs up nothing but that which is niggardly: thus do We explain the signs by various (symbols) to those who are grateful (Q. 7:58).

In this verse, the diversity of ecosystems based on their soil has been mentioned, and this difference in soil causes the emergence of various plant communities. As in the salt desert ecosystem where the soil is salty, there are few plants that can tolerate saltiness.

> And it is He who spread out the earth, and set thereon mountains standing firm and (flowing) rivers: and fruit of every kind He made in pairs, two and two: He draweth the night as a veil o'er the Day. Behold, verily in these things there are signs for those who consider! (Q. 13:3).

Rawāsī is the plural of *rāsiyyah* which means fixed and rooted, and it refers to the mountains that have roots in the ground and stand up (Tabataba'i 1999, 11:291). Because the mountains cover the earth like an armor, and this causes it to prevent the strong vibrations of the earth due to the pressure of internal gases to a large extent; on the other hand, if it were not for the mountains, the surface of the earth would always be exposed to strong winds (Makarem Shirazi 1995, 10:114). In addition, 80% of the world's fresh water comes from mountains and the mountain

ecosystem has a great impact on the climate and is very rich in terms of biodiversity. In the continuation of the verse, the river ecosystem is mentioned, which together with the mountain ecosystem are important because of the role they play in maintaining and flowing water on the earth. This flow of water causes the growth of plants, which is mentioned in the next verse. In general, in this verse, two important ecosystems, mountains and rivers, are mentioned, which play an important role in creating landscape diversity.

> And in the earth are tracts (diverse though) neighboring, and gardens of vines and fields sown with corn, and palm trees – growing out of single roots or otherwise: watered with the same water, yet some of them We make more excellent than others to eat. Behold, verily in these things there are signs for those who understand! (Q. 13:4).

The meaning of *qiṭaʿ mutajāwirāt* (tracts neighboring) is that there are different parts of the land that are next to each other and in the neighborhood of each other. Although these parts are all connected and related to each other, each of them has its own structure and talent, some are firm, some are soft, some are salty, some are sweet, and each of them has the talent to cultivate a specific type of plants and fruit trees and agriculture. Because the needs of humans and earthly creatures are many and different (Makarem Shirazi 1993, 10:116-117; Al-Ṭabrisī 1993, 6:424). Today, in the science of landscape ecology, these parts are called patches which shape the structural patterns of a landscape, and the more diverse they are, as mentioned in this verse, the more they enhance ecosystem diversity.

> And the earth We have spread out (like a carpet); set thereon mountains firm and immovable; and produced therein all kinds of things in due balance (Q. 15:19).

At the beginning of the verse the mountain ecosystem and in the rest of the verse, the plants that grow in it has been mentioned. These plants, due to their types, create different ecosystems like forest, pasture, plain, etc. The interpretation of the plant as *mawzūn* (in due balance), which is originally taken from the meaning of *waẓn* (weight), means to identify the size of everything, and it refers to the precise calculation and the wonderful order and proportional sizes in all the parts of the plants. Because the Arab uses *anbatnā* (produced) about the mine as well, it may

mean the development of various mines in the mountains (Tabataba'i 1999, 12:139; Makarem Shirazi 1995, 11:54).

> And the things on this earth which He has multiplied in varying colors (and qualities): verily in this is a sign for men who celebrate the praises of God (in gratitude). It is He Who has made the sea subject, that ye may eat thereof flesh that is fresh and tender, and that ye may extract therefrom ornaments to wear; and thou seest the ships therein that plough the waves, that ye may seek (thus) of the bounty of God and that ye may be grateful. And He has set up on the earth mountains standing firm, lest it should shake with you; and rivers and roads; that ye may guide yourselves (Q. 16:13-15).

In these three verses, various ecosystems on earth have been mentioned. In verse 13, creatures of different colors refer to mines, types of plants and animal species, elements and what is on the earth from mountains, pits and natural hills (Gonabadi 1987, 2:409; Tabataba'i 1999, 12:215), which indicates forest, grassland and mountain ecosystems. As these different ecosystems visually create different colors due to the difference in the components, that is, what God has created is not similar to some others in terms of form and composition (Al-Ṭabrisī 1998, 2:281). In verse 14, the sea ecosystem and in verse 15, mountain and river ecosystems have been mentioned.

> Set forth to them the parable of two men: for one of them We provided two gardens of grape-vines and surrounded them with date palms; in between the two We placed corn-fields. Each of those gardens brought forth its produce, and failed not in the least therein: in the midst of them We caused a river to flow (Q. 18:32-33).

In these two verses, the garden and agricultural ecosystems as artificial (man-made) ecosystems, and the river ecosystem as a natural ecosystem have been mentioned. The mention of these three ecosystems together is a key point because to have two artificial ecosystems, garden and agriculture, a water source such as a river is needed.

> And We have set on the earth mountains standing firm, lest it should shake with them, and We have made therein broad highways (between mountains) for them to pass through: that they may receive Guidance (Q. 21:31).

In this verse, the mountain ecosystem and its functions are initially addressed, followed by a reference to the valley ecosystem located between the mountains. The valley ecosystem is significant because it generally serves as a passage for rivers and has suitable grassland cover for grazing animals. It also is a place for animals to pass, which is known as a corridor in ecology.

> Gardens and Springs. And corn-fields and date-palms with spathes near breaking (with the weight of fruit) (Q. 26:147-148).

These two verses also refer to three ecosystems: the garden, river, and the agricultural ecosystems.

> Or, Who has made the earth firm to live in; made rivers in its midst; set thereon mountains immovable; and made a separating bar between the two bodies of flowing water? (can there be another) god besides God? Nay, most of them know not (Q. 27:61).

This verse refers to three ecosystems: the river, mountain, and sea. It begins with the river ecosystem, followed by the mountain ecosystem, and then discusses the sea ecosystem. Together, these three ecosystems contribute to the stability and tranquility of the earth. Also in this verse, the sea ecosystem highlights an important natural phenomenon, which is the barrier between two seas. This is elaborated in the Q. 25:53. Addressing this important topic requires independent research.

> He created the heavens without any pillars that ye can see; He set on the earth mountains standing firm, lest it should shake with you; and He scattered through it beasts of all kinds. We send down rain from the sky, and produce on the earth every kind of noble creature, in pairs (Q. 31:10).

This verse refers to the mountain ecosystem, because of the establishment of other types of ecosystem in it (such as forest and grassland ecosystems), all kinds of animals are spread in mountain ecosystem.

> Seest thou not that God sends down rain from the sky? With it We then bring out produce of various colors. And in the mountains are tracts white and red, of various shades of color, and black intense in hue (Q. 35:27).

The word *judad* is the plural of *judah*, meaning road or tract. The words *bīḍu* and *ḥumr* are the plural forms of *abyaḍ* and *aḥmar* meaning

white and red, respectively. It seems that the word *mukhtalif* (various) is an adjective describing *judad*. The term *gharābīb* is the plural of *gharīb* meaning black intense in hue. Thus, the verse states: *And in the mountains are tracts white and red, of various shades of color, and black intense in hue*. These paths refer either to the roads located in the mountains that have different colors or to the mountains themselves, which appear as lines drawn on the earth's surface. Some of these mountain ranges are white, some red, some black, and others are multi-colored (Tabataba'i 1999, 17:42). Based on this explanation, the verse refers to the diversity of colors in the veins present in the mountains, resulting from the colors of the rocks and soil, which contributes to the diversity of the mountain ecosystem and the establishment of various plant covers and ecosystems.

> And We produce therein orchard with date-palms and vines, and We cause springs to gush forth therein (Q. 36:34).

The main meaning of *'ayn* (spring) is "eye," and it is used in various contexts to convey different meanings. A spring is referred to as *'ayn* because, like an eye, it contains water and serves as a source of water (Al-Rāghib al-Iṣfahānī 1991, 598-599). The word *fajjarnā* is derived from the infinitive *tafjīr*, meaning to create a wide fissure (Al-Rāghib al-Iṣfahānī 1991, 625). Since springs emerge from the ground through fissures, this expression is used to describe the emergence of a spring from the earth. Based on this, the verse refers to gardens and rivers (along with a focus on the origin of some rivers) ecosystems.

> And the earth - We have spread it out, and set thereon mountains standing firm, and produced therein every kind of beautiful growth (in pairs) (Q. 50:7).

This verse initially refers to the mountain ecosystem and then broadly mentions all the plant ecosystems established within it.

> And We send down from the sky rain charted with blessing, and We produce therewith gardens and Grain for harvests. And tall (and stately) palm-trees, with shoots of fruit-stalks, piled one over another (Q. 50:9-10).

Jannāt means gardens that have trees bearing various delicious fruits. Explanations were given earlier about the meaning of *ḥabb* (grain). In the first verse, the meaning of *ḥabb al-ḥaṣīd* is the harvested grain (Makarem Shirazi 1995, 18:341; al-Ṭabrisī 1993, 9:213). Based on what was said, these two verses refer to garden and agricultural ecosystems.

> And We split the earth in fragments, And produce therein corn, And Grapes and nutritious plants, And Olives and Dates, And enclosed Gardens, dense with lofty trees, And fruits and fodder (Q. 80:26-31).

All of these verses refer to plant ecosystems, including agricultural, garden, and pasture ecosystems. The importance of these ecosystems is in providing food for humans.

4. Conclusion

The Holy Qur'an introduces fundamental characteristics of the universe and highlights significant features of the natural world, inviting humans across all eras to reflect deeply upon them. Understanding biodiversity is essential for comprehending the multiple dimensions of nature, as it underpins all life-sustaining processes on Earth. This study examined biodiversity in the Qur'an at three levels: genetic, species, and ecosystem diversity. The key findings at each level are summarized as follows:

At the genetic diversity level, several verses illustrate genetic variation within human beings and other organisms, manifested in differences such as skin color and other traits, which give rise to distinct races. Regarding species diversity, the Qur'an addresses variation among plant species from multiple perspectives, including:

- Diversity based on flower types, such as plants with compound spike inflorescences;
- Diversity in stem structures, distinguishing trees with a single main trunk from shrubs with multiple stems;
- Variation in fruit types, exemplified by date palms with clustered fruits;
- Differences in seed types, such as husked seeds;
- Variation in color and other features.

Additionally, animal species diversity is highlighted through:

- Differences in locomotion organs referencing four classes of vertebrate phylum;
- Diversity in livestock species serving human needs such as transport, food, and clothing;
- Variation in color and other distinguishing characteristics.

At the ecosystem diversity level, the Qur'an mentions a variety of ecosystems including forests, grasslands, gardens, agricultural fields, pastures, rivers, mountains, valleys, deserts, and marine environments. Additionally, in some of the ecosystems mentioned, further details are provided. For instance, in the mountain ecosystem, the diversity of colors in the veins present in the mountains, resulting from the colors of the rocks and soil, is referenced, which contributes to the diversity of the mountain ecosystem.

Overall, this research underscores the Qur'an's emphasis on the diversity of life as a manifestation of divine creativity. This diversity not only expresses God's wisdom and power but also highlights the indispensable role of biodiversity for the balance and sustainability of the natural world-its absence posing serious threats today. Previous studies (Muhamad 2015; Solihu 2014) likewise affirm that the Qur'an portrays biodiversity as a purposeful divine provision and a sign of God's existence and unity. While the Qur'an's primary aim is spiritual guidance, it contains many implicit scientific facts that can advance human knowledge. It discusses natural phenomena and the roles of natural factors in their occurrence (Rohani Mashhadi & Hasanzadeh 2022). The findings of this study provide insights for researchers interested in the intersection of science and religion, reaffirming the Qur'an as a profound repository of knowledge consistent with modern scientific understanding. It highlights the importance of detailed and rigorous analysis of Qur'anic verses in light of scientific evidence, encouraging further interdisciplinary studies that bridge sacred text and empirical science.

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